

# RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

VOL. V

NOVEMBER, 1925

No. 5

## RADIOGRAPHY OF THE INFANT CHEST, WITH SPECIAL REFERENCE TO THE "PROGRESSION OF THE CHEST AND THE DETERMINATION OF THE NORMAL"<sup>1</sup>

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IF ONE makes a careful review of the literature regarding the infant chest or makes any observations as he goes about in his practice of medicine, he is impressed with the chaos, the indecision and uncertainty in diagnosing the diseases of the infant chest. There has been considerable written by a wide variety of observers, both on observations of the pathology and upon the attempts to reveal this pathology by both clinical and X-ray methods. It is generally conceded that the X-ray has some value, but it is usually mentioned in connection with older children, ten to sixteen years of age, and in those cases showing fairly gross pathology. One of the latest and most careful efforts to help the situation was made by the National Tuberculosis Commission, which reported rather unsatisfactory results. It seems peculiar that there has not been more concerted effort along this line, both before and since. There are on record many individual reports of observations and of attempts to improve their individual diagnostic accuracy, showing the great need in this field. Of these, Dr. Pancoast, Dr. MacRae, Dr. Chadwick, Dr. Evans, Dr. DeBuys and Dr. Samuel in our country have perhaps written the most. The consensus of opinion has been and is to-day that the radiograph of the chest has little diagnostic value in the infant or child except for the grosser

pathology. The rapid changes in growth and from childhood diseases and the technical difficulties involved have been too baffling. Even the thymus, except by a very few, is supposed to be either difficult or impossible of accurate diagnosis. Glands at the hili, without mention as to their character, are passed as unimportant and as a normal finding. Very little is said in regard to the lung structure and most writers prefer to pass it unnoticed. If lung structure is described, the linear markings or hili are mentioned as shadows of vague outlines and probably made up of certain structures. But the shadows are too indistinct to attempt to differentiate these structures.

The physical examination is equally unsatisfactory, as the sounds conveyed by the stethoscope or percussion are confusing and often overshadowed by the natural bronchial breathing or resonance of the child's chest. The Von Pirquet test is given a place of considerable importance, but often does not help us when most needed. The clinical history, the general physical examination and the observation of the patient are, no doubt, the most reliable guides at the present time. These will tell us there is unquestionably something wrong with the child, and, yet, as there is often no cough, no sputum, we will still be in doubt as to the location and nature of the lesion. We always fear that the malaise, the loss of weight, the slight temperature,

<sup>1</sup> Read before the Radiological Society of North America, at Atlantic City, May, 1925.

or the nervousness may be caused by some unknown factor.

In brief, I am impressed with the observation that the accuracy in diagnosis of diseases of the chest is in direct ratio to



Fig. 1. Radiograph of adult. Two exposures made on same film. One at systole and one at diastole. Shadows then traced, showing range of motion of intrathoracic viscera.

the age of the patient from birth to adult age. In other words, we are much more accurate with our methods of diagnosing, medically, radiographically, or from a laboratory standpoint, in adults than in children, and the younger the child, the greater our difficulties. It also seems that we must wait for the infant to develop a condition so marked that fatality is apt to ensue before we can be clear as to the condition. Or else the process becomes more or less latent, to develop into a serious condition in adult life. We might ask ourselves the question, "Is this a peculiarity of the infant or child that is unconquerable, or is it a lack of sufficient knowledge on our part of the problems and the resulting inability to use the methods we have at hand?"

There is considerable evidence at hand to make one feel that, besides the diseases which arise and terminate in the infant, there are many diseases, notably tuberculosis, bronchiectasis, bronchitis and asthma, which have their origin in early childhood. It is also quite possible that this incidence is much higher than we know. Certainly if diseases originate in childhood, then is the time to diagnose them and to institute prophylactic measures to prevent the recurrence in later life. From the foregoing, it seems that additional diagnostic methods for the infant or child would be of the greatest value to mankind, not only in revealing the nature of those diseases originating and terminating in childhood, but in prevention of those originating in childhood and terminating in adult form. One would hesitate to place an estimate of the value to the public of any such method and its results in the fight of even just one of the many diseases.

Meeting these problems daily in my practice of radiology, the whole complex became such a source of daily irritation as to force me into some sort of an investigation. After a modest survey, I had some hopes that the technical difficulties might be overcome. I also realized that I knew absolutely nothing about what I could expect to be portrayed upon the radiograph of an infant chest or what I saw upon such radiograph. Certainly, this lack of knowledge of the anatomy and physiology was fundamental. I had some conception as to what was written regarding the pathology, but this was all postmortem work and not that of the normal living or of the incipient disease. Some writers led me to feel that there was no great difference in the childhood diseases and that we should not expect much upon the radiograph in the way of differential diagnosis. Group studies seemed unsatisfactory, as we could have no knowledge of what had taken place or what took place later. Also we knew that the anatomy, physiology and also pathology are changing in infants from week to week and year to year and one

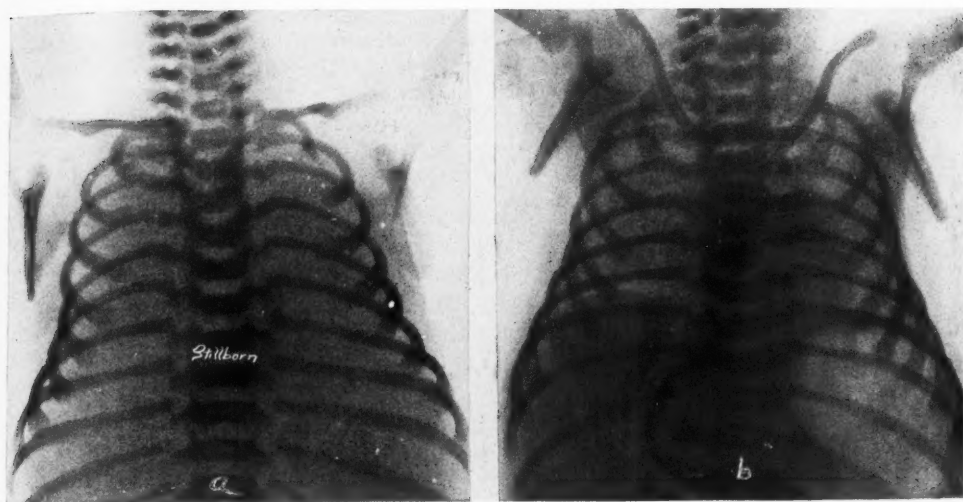


Fig. 2. (a) Stillborn infant. (b) Stillborn infant in which mouth-to-mouth resuscitation was attempted. Note that air has filled stomach as well as lungs.

could not help but draw the conclusion that the radiograph of an infant one year old would not be the radiograph of a child six to ten years of age. One could also readily conclude that the fibrous tissue, which is spoken of so much in the interpretation of radiographs of adults, would vary according to the age and, likewise, other findings, as the lymphoid tissue and the general markings of the chest, would be ever changing, both as a result of growth or environment or of diseases which have come and gone. Without any preconceived ideas as to the exact situation, I then set about to find some method to throw light upon the actual facts.

For some five years, I experimented to obtain a technic that would overcome the difficulties in radiography of the adult chest.<sup>2</sup> Having satisfied myself that I was finally able to portray quite accurately the minute structure of the adult lung, I then applied the same technic to infants and found that the same principles held true. It was then decided that it was feasible and also the best method to begin the study of

the infant at birth before any changes in the lung have taken place.<sup>3</sup> The co-operation of the medical profession of Denver was solicited and through them the co-operation of the parents. The babies were radiographed during the first two weeks after birth and every four weeks thereafter until they were three months of age, then every three months until one year of age, and every three months thereafter unless conditions warranted the radiographs being taken more often. In the beginning, only the chest was radiographed, but later the sinuses also were included in our routine. The chests are radiographed in the anteroposterior or lateral positions, usually recumbent, but at times upright and at both inspiration and expiration. The usual positions are used for the sinuses. As these babies required other examinations for completing the necessary data, certain doctors were asked to give their aid. Dr. Waring has made the physical examinations, dealing particularly with the lungs; Dr. Burnett has given special attention to the heart and vascular system, and Dr. Carmody, the sinuses, paying particular attention to their development and their effect upon the mediastinum and pulmonary

<sup>2</sup> This technic will be described later.

<sup>3</sup> This work is being accomplished through the aid of the Selme Winter Foundation.

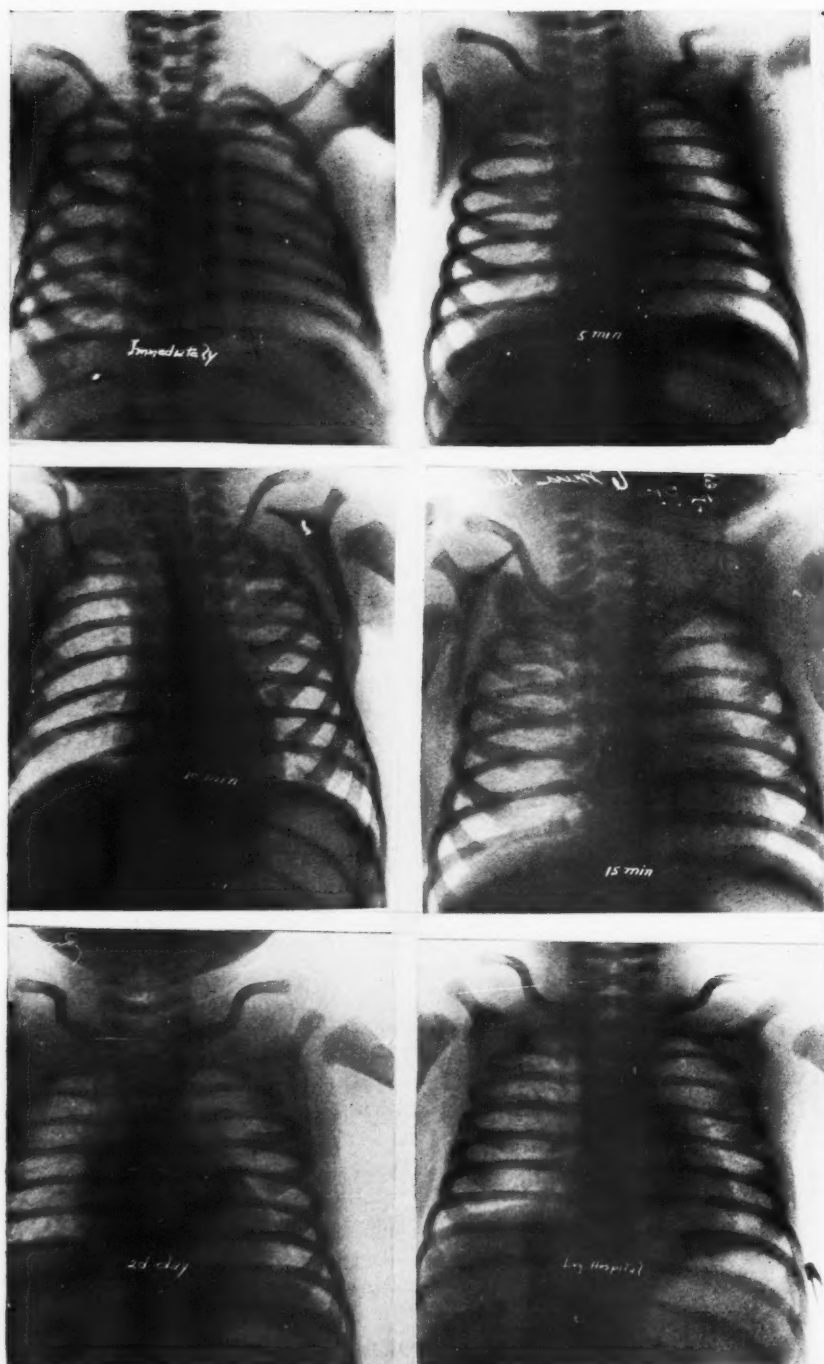


Fig. 3. Radiographs of an infant from birth until time of leaving hospital. Note gradual expansion of lungs.

structures. For these studies to be comprehensive, and intelligently carried out, they must be guided by postmortem examinations, as will be more fully described later. The pathological sections are being studied by Dr. Mugrage and Dr. Bouslog through the Pathological Department of the University of Colorado. Detailed reports dealing with their conclusions within their particular field will subsequently be given by these doctors. It has been our endeavor to obtain one hundred infants for such study, but we have not accepted them all at one time as we have preferred to add to our list as our knowledge has grown little by little and as we overcame what seemed in the beginning to be insurmountable difficulties. We now have fifty-six babies in the series, varying from a few weeks to three years of age. We also have many special cases that we have taken for study because of some unusual condition. Our series is also supplemented by group studies of varying ages and by a considerable post-mortem series. A great deal of knowledge and help has also been gained through cases referred by the Children's Hospital and the general medical profession of Denver. The children are checked by repeated Von Pirquets and studies have been made as to their environmental and social conditions. They are taken from all classes of society and from homes where there is tuberculosis and from homes where there is no evidence of such disease.

After four years of such investigation of the infant, as just outlined, I wish to take the following thesis:

1. Radiographs of the infant chest can be taken with the same accuracy as those of the adult.
2. There are differences in the diseases of the infant chest as there are in the adult.
3. These diseases and their differences can be portrayed upon the radiographic film.

In order that I may present more clearly my material upon which I base my conclusions, allow me to reminisce for a few mo-

ments. Since 1917, a series of papers<sup>4</sup> have been given with the following conclusions:

First, I called attention to the natural advantages and disadvantages of the anatomy in radiography of the chest and that to overcome one of these fundamental disadvantages, namely, the intrathoracic movement, we must cut our exposure to at least one-tenth of a second. The advantages of the double intensifying screens and films were mentioned, making it practical to use such an exposure in daily routine. This was a report of work done in 1917, and such a technic with gradual improvements has been used in routine practice since that time.

A little later, I endeavored to emphasize the importance of technic and called attention to Dr. Orndoff's fundamental work on the focal spot and the amount of movement that can be detected by the eye.<sup>5</sup> At this time, it was suggested that the technician measure the anteroposterior diameter of all patients in order that he might know the exact exposure necessary and the distance at which he should work for that particular focal spot. Some of the factors affecting connective tissue changes were noted and mention made of the necessity of being able to show normal anatomy. In 1920, I endeavored to explain further the intrathoracic movements by showing how the lungs rock about their hili from the expan-

<sup>4</sup> Some Observations in Roentgenography of the Chest. W. W. Wasson, M.D. Read before Western Roentgen Society, Chicago, November, 1918. *Journal of Radiology*, January, 1920.

Roentgenography of the Chest. W. W. Wasson, M.D. Read before Omaha Roentgen Society, April, 1919. *Journal of Radiology*, September, 1919.

A Study of Intrathoracic Movements. W. W. Wasson, M.D. Read before Colorado State Medical Society, September, 1920. *Colorado Medicine*, April, 1921.

The Technique of Chest Radiography. W. W. Wasson, M.D. *Journal of Radiology*, November, 1921.

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The Progression of the Chest and the Determination of the Normal: Preliminary Report. W. W. Wasson, M.D. *Journal of Radiology*, March, 1923.

The Gross Pathology of the Chest. W. W. Wasson, M.D. *Radiology*, July, 1924.

The Infant Chest as Seen at Birth. W. W. Wasson, M.D. *Journal of the American Medical Association*, October 18, 1924, LXXIII, p. 1240.

<sup>5</sup> Roentgenography of the Chest. See Footnote 4.

sion and contraction of the heart and aorta.<sup>6</sup> The time necessary to stop this motion on the radiograph was calculated from the heart cycle and the path in which the bronchi and the vessels would move. The movements of the diaphragm and

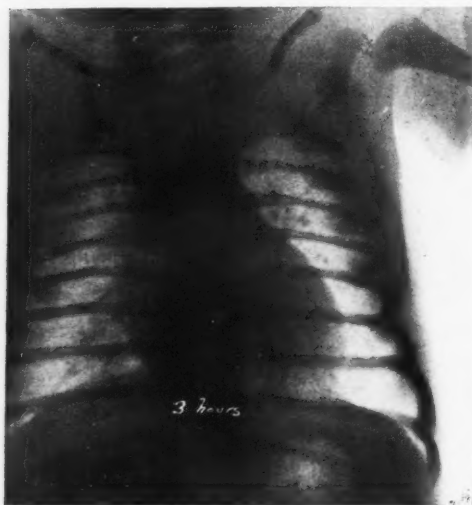


Fig. 4. Infant three hours after birth. Note linear markings and appearance of nodes.

changes in the position of the hili and bronchi during inspiration and expiration were also described. This knowledge of the true physiology of the thoracic viscera is most essential in radiography of the chest. Later,<sup>7</sup> data were collected as to the greatest anteroposterior diameters of the chest which one encounters and as to the kind of focal spot necessary and the distance at which we should take our radiographs in order to properly portray the changes within the chest. The results of such technic were then described, showing how one may see the most minute lung structure and the very slightest change from the normal. Attention was called to the fact that because a bronchus happened to show in the periphery of the lung, it did not mean that it was pathological, but rather that we should

study the character of the bronchi and the hili and determine from their characteristics whether or not they were pathological. In 1922,<sup>8</sup> I lamented the fact that we were unable to properly understand this minute structure and minute pathology of the lungs and laid stress upon the fact that the lungs are changing constantly from birth to old age as a result of environment, physical conditions and disease, and that certain diseases must be considered as a part of the normal process. This change, which is never-ending, we called the "progression of the chest," and described a plan for studying children from birth to adult life, by which we hoped to unravel some of these mysteries.

Turning to typical forms of pulmonary diseases as one source of information, these were divided into four large classes: tumors, infection, circulatory disorders and irritants.<sup>9</sup> It was noted how closely the radiograph resembled the picture seen at the postmortem table and on studying the radiograph and endeavoring to account for these cardinal types of disease, it was observed that there are three great factors: first, all blood from all the other organs of the body must pass through the lungs; second, there is a direct connection between the lymphatic supply of the mediastinum and lungs and that of the abdomen or neck and head; third, the lungs are the only internal organs directly connected with the outside air. These factors give the pulmonary structures a wider variety of diseases than any other organ of the body. Stress was laid upon studying the cardinal signs of disease as seen upon the radiograph.

A series of infants as studied at the time of delivery and subsequent two weeks was reported in 1924.<sup>10</sup> Observations were made as to the appearance of the chest in

<sup>6</sup> A Study of Intrathoracic Movements. See Footnote 4.

<sup>7</sup> Further Observations and Clinical Findings in Roentgenography of the Chest. See Footnote 4.

<sup>8</sup> The Progression of the Chest and the Determination of the Normal: Preliminary Report. Compare with Footnote 4.

<sup>9</sup> The Gross Pathology of the Chest. Compare with Footnote 4.

<sup>10</sup> The Infant Chest as Seen at Birth. Compare with Footnote 4.

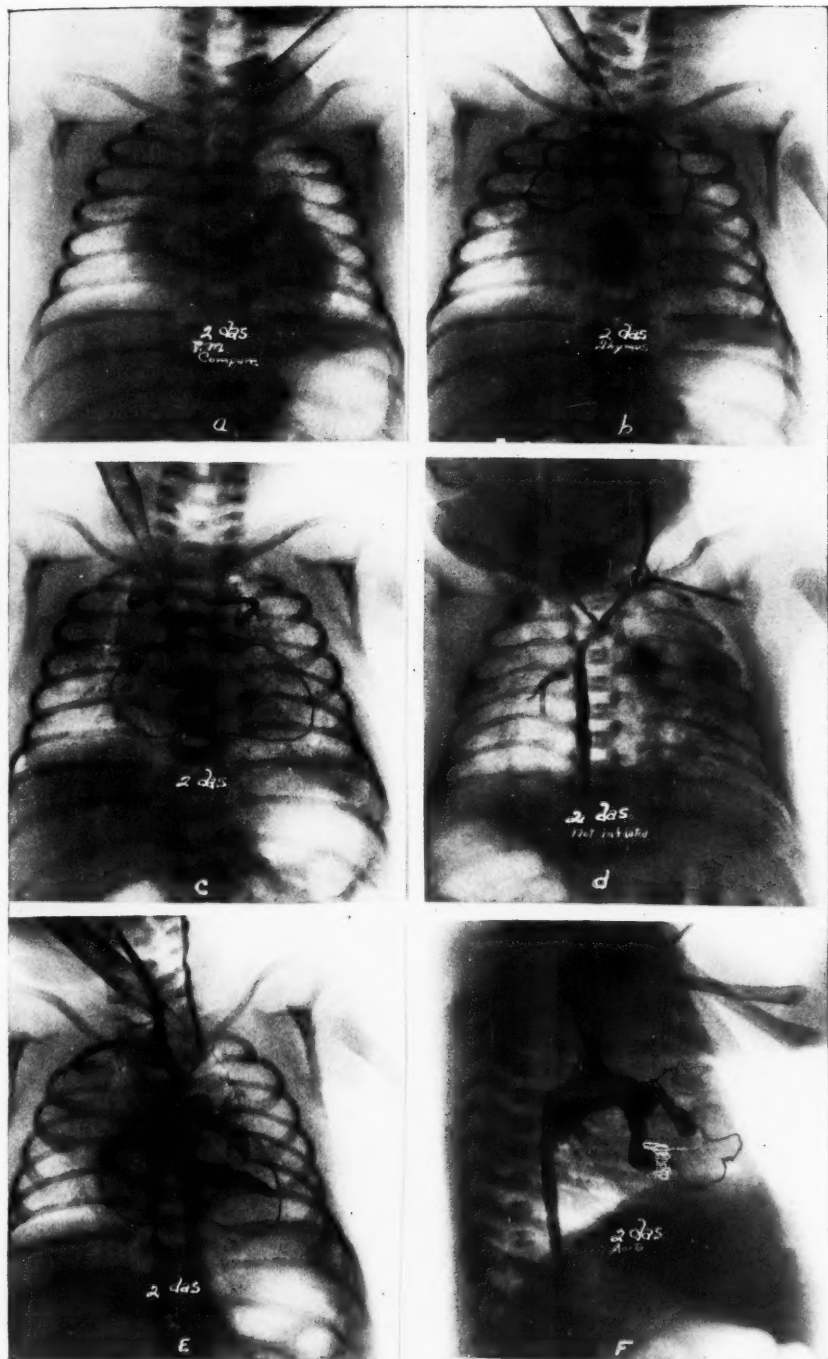


Fig. 5. Postmortem of infant two days old for identifying mediastinal shadows. (a) Inflation of lungs through cannula in the trachea. This inflation is maintained throughout except in (d). (b) Lead foil about thymus. (c) Fine copper wire about thymus and heart and lead foil along mediastinal pleural reflection over thymus. (d) Arteries of left lung injected but intrathoracic pressure released. (e) Aorta and pulmonary artery injected, showing pulmonary artery lying to the left. (f) Lateral view of (e) showing aorta passing directly backward from heart.

the stillborn and the phenomena connected with the time necessary for the expansion of the lungs and the clearing of the atelectasis after delivery. A description was given of the radiograph of the chests of



Fig. 6. Lungs removed from child four years of age and inflated but not injected. Note how the arteries (a) and bronchi (b) may be traced. Also note absence of veins and no evidence of lymphatics.

infants with fully expanded lungs. It was particularly noted that the linear markings were very distinct.

Based on the above investigation, extending over a period of years, and with our experience gained upon the infant, our technic is now as follows:

The time of exposure is  $1/20$ th of a second. The voltage is varied according to the thickness of the chest. The distance best suited to all present conditions seems to be 50 inches. Using double intensifying screens and films, sufficient milliamperage is given under these conditions to produce the proper chemical change in the emulsion with six minutes' development and the developer at 65 degrees. In other words, the distance, the time, the developing is kept constant, and the milliamperage upon any particular machine is kept constant, but this latter factor may vary, according to installations, from 150 to 250 milliamperes. The child is best taken in an upright position, though the recumbent po-

sition may be utilized almost as well, if advisable. The radiator tube<sup>11</sup> with a focal spot of six millimeters in diameter is the best for this purpose, and under the proper technic will last for many months. In making preliminary tests upon any tube selected, it is best to use the Universal Coolidge type tube for the experimenting to determine the number of milliamperes desired and the voltage. Either a spark gap or a sphere gap may be used in making the voltage determination. An ammeter in the filament current and a prereading voltmeter are also necessary. The plan for making test is then as follows:

Having inserted Universal tube, set the spark gap or sphere gap at an arbitrary distance, as 81, and now regulate the ammeter until the milliamperemeter reads another arbitrary amount, as 140, and regulate the prereading voltmeter until the sphere gap is 81. We then have the readings as in Test No. 1. Let us now raise the ammeter reading  $1/10$ , that is, from  $4.7\frac{1}{2}$  to  $4.8\frac{1}{2}$ , and keep the prereading voltmeter constant, as in No. 1, and make a second test. We now have the readings in Test No. 2. In other words, the milliamperage has been raised 15 milliamperes and the voltage has dropped 6 K.V.P. Holding the ammeter constant at  $4.8\frac{1}{2}$  and thus the milliamperes, now regulate the prereading voltmeter until the spark gap is again 81 K.V.P., and we have the readings in Test No. 3. From these three tests we can draw the conclusions noted below and from these conclusions calculate the settings necessary for any milliamperage at any voltage.<sup>12</sup> Let us now assume that 155 milliamperes is the reading desired for chest work. Remove the Universal tube and insert the radiator tube, setting the timer at  $1/20$ th of a second, but leaving the prereading voltmeter at 110 and the

<sup>11</sup> A new high milliamperage tube is now available for chest work and should be given preference.

<sup>12</sup> This method of calculation has been a great satisfaction to me in years past and I am sure anyone else who practises it will find it so.

sphere gap at 81 as in Test No. 3. Using the timer, the tube may now be flashed and the ammeter regulated until the sphere gap is 81. Then, since the voltmeter was left constant, the milliamperage must then be 155 and we have the readings in Test No. 4,

obtained with no injury to a delicate tube. From this, any milliamperage or voltage may be calculated without further tests. (It has been found that filament current readings are almost interchangeable for each radiator tube.)

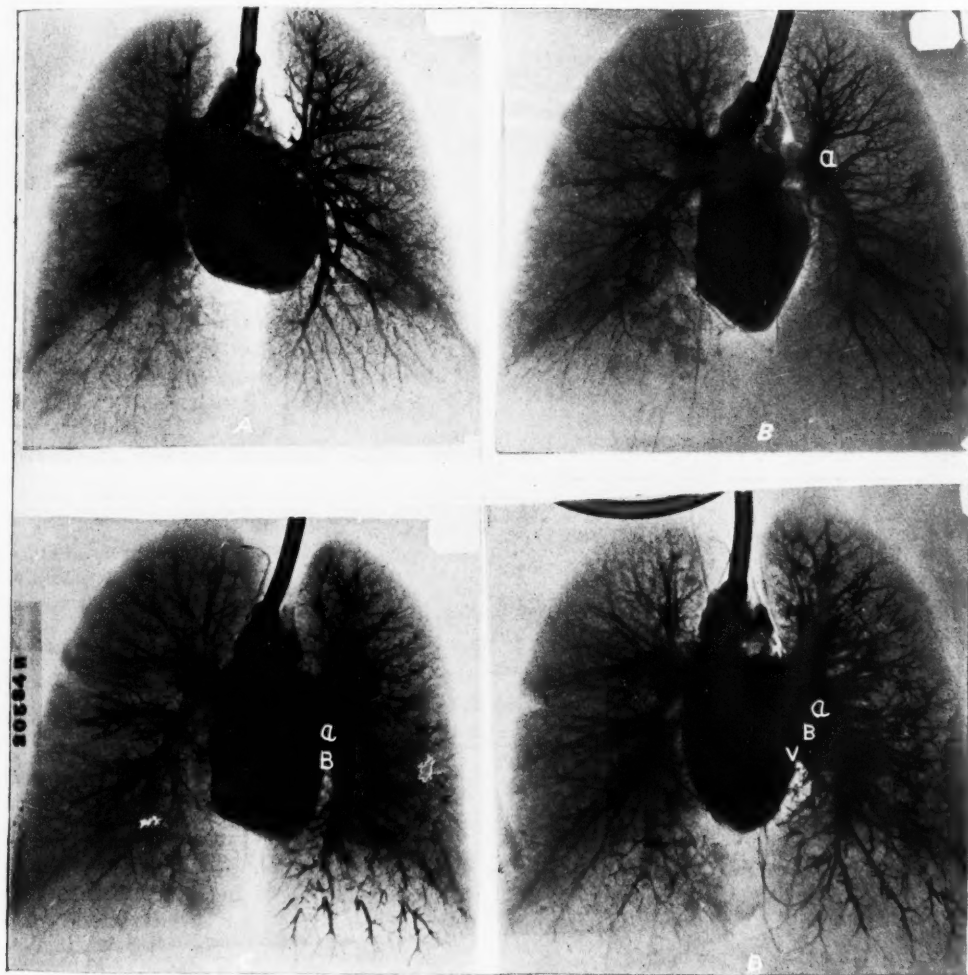


Fig. 7. Same specimen as Figure 6. Compare *a* and *b*: Injection of pulmonary artery (*a*); (*c*) Injection of left bronchus (*b*); (*d*) Injection of left pulmonary vein (*v*).

## CHEST TUBE TESTS

## Universal Coolidge Tube

	Am- meter	Milli- amperes	Prereading Voltmeter	Sphere Gap K.V.P.
Test No. 1....	4.7½	140	105	81
Test No. 2....	4.8½	155	105	75
Test No. 3....	4.8½	155	110	81

*Conclusions:*

Then with voltmeter reading constant and a regulation of 1/10 on ammeter scale there is an increase of 15 milliamperes, with a drop of 6 K.V.P. An increase of 5 volts restores K.V.P. to first reading. That is—

1/10 reading increase on ammeter scale = 15 milli-ampere increase.

1/20 reading increase on ammeter scale = 7½ milli-ampere increase.

5 primary volts increase = 6 K.V.P. increase.

2½ primary volts increase = 3 K.V.P. increase.

(3 K.V.P. = approximately ¼ inch point spark gap.)

## Now insert Radiator Tube

	Am- meter	Milli- amperes	Prereading Voltmeter	Sphere Gap K.V.P.
Test No. 4....	4.5½	155	110	81

Regulated to give 81 K.V.P. as in Test No. 3.	Then this will be correct.	Constant from Test No. 3 with Universal tube.
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*Conclusions:*

Holding voltmeter constant and inserting radiator tube for Universal tube and regulating ammeter as indicated, we then obtain proper ammeter setting for desired K.V.P. The milliamperes will then be correct.

Having now determined the setting of the ammeter in the filament current which will give the proper milliamperes and the setting of the auto-transformer to produce the proper voltage, we are then working under the following conditions:

The time is 1/20th of a second, the distance 50 inches, the ammeter setting is constant and we vary only the voltage, which is easily done by the auto-transformer control. The dark-room conditions are constant, as stated above. There is no testing of the radiator tube necessary after the one described above to determine the ammeter setting for that particular tube. It is then only necessary to place the patient in position, make the measurement anteroposterior of chest and the proper setting for voltage, and push the time switch. In infants, it is very necessary to make the set-up first

before placing patient in position. The voltage is regulated as follows, together with a chart as used in practice at a 44-inch distance.

*Readings:*

Tube—1/20th of a second Film-anode distance—44 inches		Films and double screens Tube—Radiator Coolidge		
Depth of Patient	Am- meter	Milli- amperes	Prereading Voltmeter	Sphere Gap K.V.P.
4	4.5½	155	90	57
4½	4.5½	155	92½	60
5	4.5½	155	95	63
5½	4.5½	155	97½	66
6	4.5½	155	100	69
6½	4.5½	155	102½	72
7	4.5½	155	105	75
7½	4.5½	155	107½	78
8	4.5½	155	110	81
8½	4.5½	155	112½	84
9	4.5½	155	115	87
9½	4.5½	155	117½	90
10	4.5½	155	120	93

This chart may then be simplified, as follows:

Tube—Radiator Distance—44 inches	Time—1/20th of a second Ammeter—4.5½
Depth of Patient	Voltmeter
4	90
4½	92½
5	95
5½	97½
6	100
6½	102½
7	105
7½	107½
8	110
8½	112½
9	115
9½	117½
10	120

With this same technic and only one variable factor from patient to dark room, the radiographs should run very uniformly and no rechecks be necessary. After nine years' use, I feel that I can recommend it to the profession. Fluoroscopic work is needed only in unusual cases to supplement the radiographic findings.

After making the series of radiographs, studying the first expansion of the lung after birth, as noted above, it became quite evident that we must study further the anatomy of the chest and be able to identify

the shadows cast by this anatomy upon the radiographic film. It is one thing to know there is such anatomy and quite another to actually see it on the film. In other words, in spite of our wealth of detail, there came the question as to whether we were seeing bronchi or arteries and veins, thymus or mediastinum and its great vessels, and so on. Some Europeans have stated that the bronchi do not show in the infant, and no work, or, at the most, very little, either in Europe or America, has been done to identify the radiographic shadows in the infant or child chest and thus establish a basis for the study of the infant and child. Without this knowledge and without the ability to portray the anatomy upon the film by a suitable technic, we can have no place from which to start our study of the infants or the older children, and, in turn, the adults. And further, without this knowledge, we are left groping about for evidence and without a true foundation upon which to place this evidence, once it is gathered. Dr. Dunham and Dr. Miller did considerable research along this line in the adult, using the adult chest and that of some animals. Dr. Miller has spent years in his studies of anatomy of the chest and I would refer anyone to his work for detailed knowledge of the minute anatomy. Some investigators have studied the pathology and anatomy as found at the postmortem table, as Noback, but I have been unable to obtain any appreciable help in identification of this anatomy and pathology when seen upon the radiograph.

Our plan for study of this problem has been as follows:

1. Wherever possible, to have radiographs of the chest just before death and immediately afterward, upon the same body.
2. After making an incision in the neck and opening up the trachea, the lungs are carefully inflated to their normal capacity, and radiographs made.
3. Insufflation and injection of the bronchial tree through this tracheal inci-

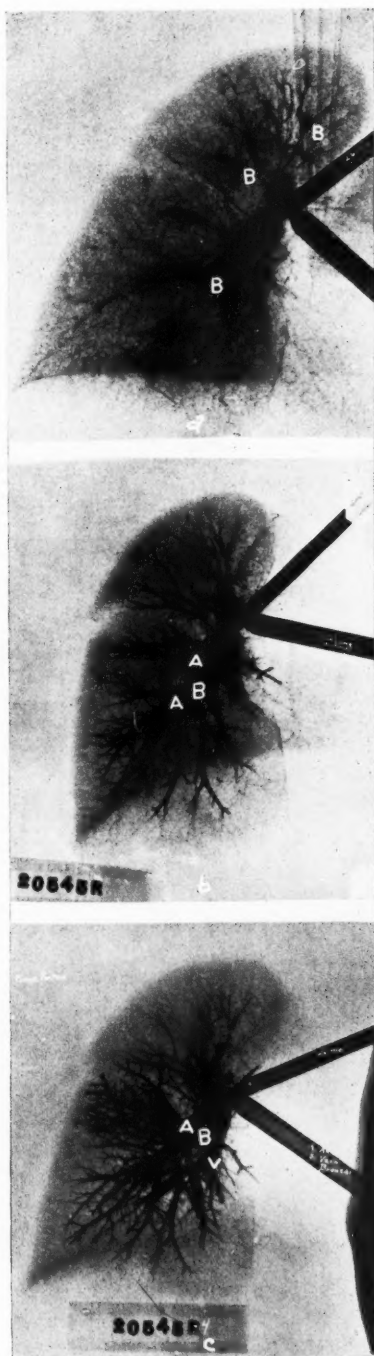


Fig. 8. Right lung of infant 26 months of age, removed, inflated and injected, especially the lower lobe. (a) Insufflation of bronchi (b); (b) Injection of pulmonary artery (a); (c) Injection of pulmonary vein (v).

sion, at the same time maintaining the lung pressure, and radiographs made.

4. The chest is now opened by the usual method of removal of sternum and manubrium and the arteries injected and radiographs made, then the veins injected and radiographs made, at the same time maintaining the intra-pulmonary pressure

and the stitching of the sternum and manubrium into position before each radiograph.

5. Small threads of copper wire are placed about the thymus, and radiographs made, still maintaining the intra-pulmonary pressure, and the heart similarly outlined, and radiographed.

6. The reflections of the mediastinal

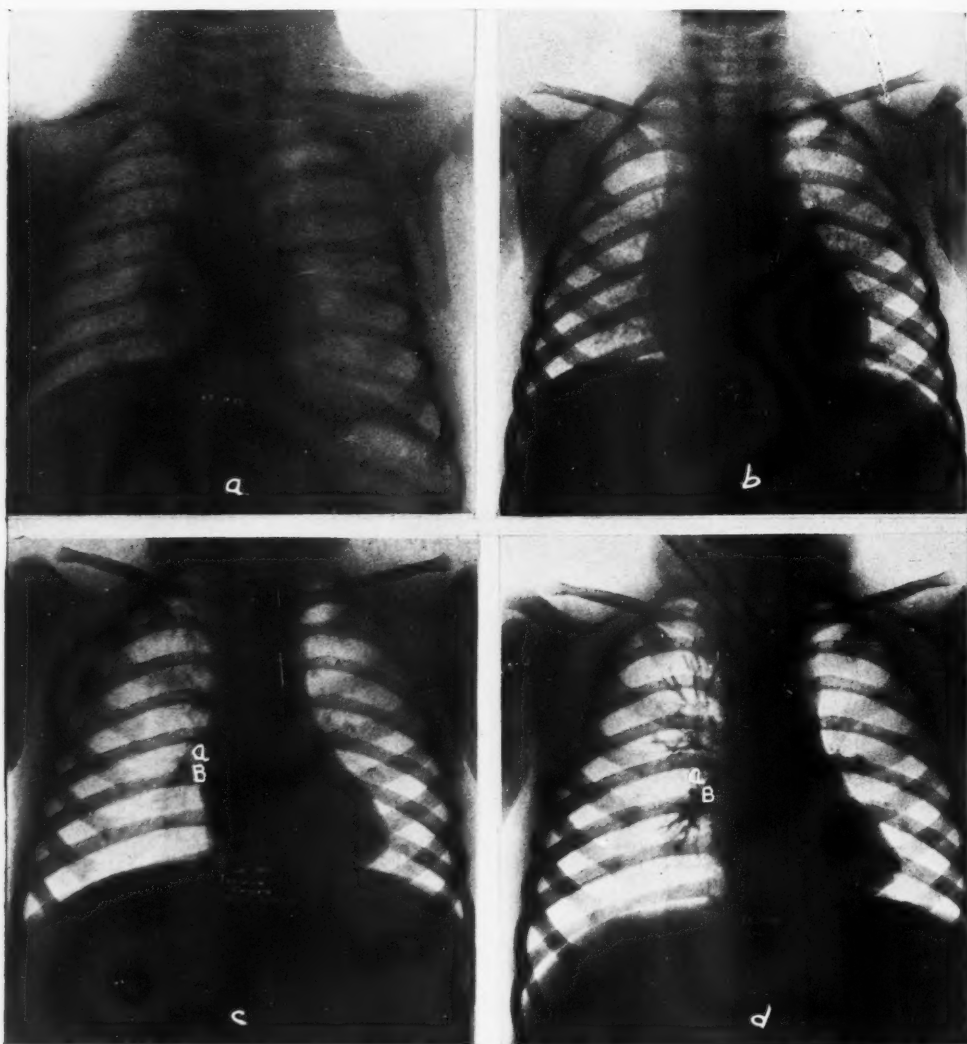


Fig. 9. Infant who died suddenly on table at 26 months. (a) Radiograph made at 11 weeks of age. Small thymus. (b) Radiograph made after death showing large thymus, as also proven by postmortem. (c) Over-inflation of specimen: (b) squeezing thymus. Note pulmonary artery at (a) and bronchus at (b). Chest not opened. (d) Same as (c), with injection of bronchus through trachea. (b), Bronchus. (a), Artery.

pleura are outlined with small strips of leadfoil, and radiographs made, and also radiographs made following injection of the pulmonary arteries and veins and the aorta.

7. Postmortem is then held, studying carefully the thoracic viscera and correlating the findings with those upon the radio-

graph. This is done not only by visual demonstration but by careful measurements of the structures as found at the postmortem and as seen upon the radiograph. The measurements of the diameter of the right lower bronchus and artery as actually found at the postmortem are compared with those as seen upon the radiograph

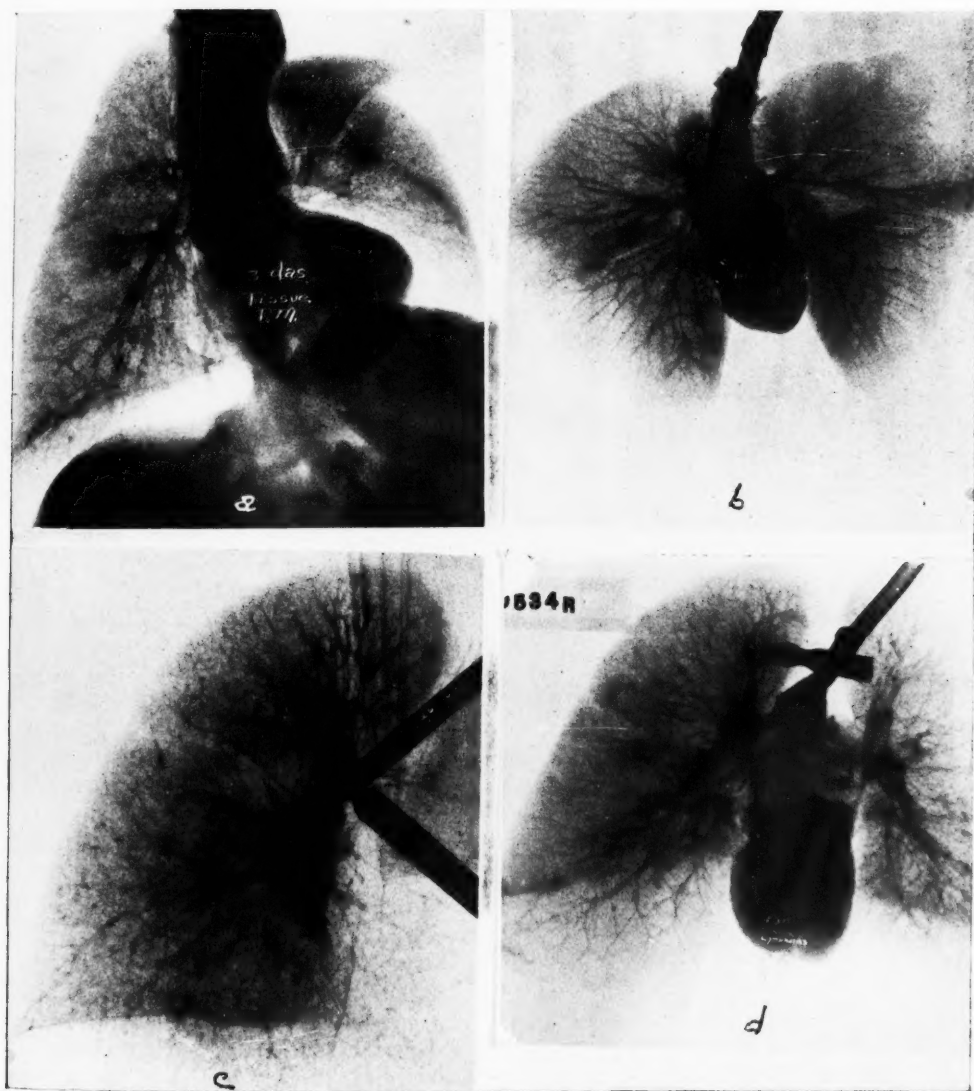


Fig. 10. Compare connective tissue changes in inflated infant lungs from three days to four years. (a) Infant three days old. (b) Infant two months old. (c) Infant 26 months old. Note that bronchi in this specimen contain a little barium powder. Other specimens not injected. (d) Child four years old.

before and after death and after injection. If we measure the air column of the insufflated bronchus as seen upon the radiograph and compare this with postmortem lungs *in situ*, it should identify that particular bronchus. And if we measure the bronchial wall upon the radiograph and compare this measurement with the bronchial wall *in situ*, it should identify this structure. This method can also be applied to arteries and veins.

8. In some cases careful dissection of the lungs and thoracic vessels is now made, supplementing the information gained above. For example, the distance between the bronchi, arteries and veins can be measured and compared with the radiograph.

9. In other cases, after removing the lungs and having studied the other thoracic viscera, the lungs are then inflated, radiographed, and, maintaining this inflation, are injected and repeatedly radiographed. Measurements and dissection as noted above can then be carried out.

10. The following blocks of tissue are then taken for microscopical study:

1. Trachea at bifurcation.
2. Right and left bronchus before entering hilus.
3. Section through middle of hilus.
4. Main bronchus just after entering upper right lobe.
5. Main bronchus just after entering middle lobe.
6. Main bronchus just after entering lower right lobe.
7. Main bronchus just after entering upper and lower left lobes.
8. Section of parenchyma of the apex and base of each lobe of each lung.

(This list would often be supplemented by other blocks of tissue from other portions of the lung, according to conditions found.)

It will be noted that this plan of study has certain advantages; *i.e.*, we have radio-

graphs both before and after death, also the experiments are carried out without disturbing relations of the viscera and with intra-pulmonary pressure and without the removal of the blood from the arteries and

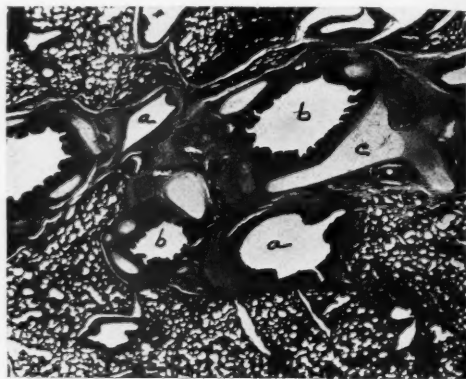


Fig. 11. Cross-section of bronchus (b) and artery (a). Magnified 10X. Note how they are held together by connective tissue and surrounded by air spaces. (c), Cartilages.

veins. I cannot emphasize too strongly these points.

These studies were carried out upon stillborns, upon infants a few hours old, and upon infants ranging from a few months to four years of age. Many of our cases died from causes other than thoracic and some showed definite pathology. This evidence of pathology, when found, was studied and correlated with the amount of pathology shown upon the radiograph.

After making these investigations, noting all observations in detail and watching carefully the technic of each experiment, I came to some definite conclusions. Thus at birth, the shadow usually attributed to the heart is that of the heart, that the right border of the heart is formed by the superior and inferior venæ cavæ and the right ventricle lies to the left of the right border of the heart and the left auricle above and to the left. The left border of the heart is formed by the left ventricle. The two auricles and the great vessels form the base of the heart shadow. The superior vena

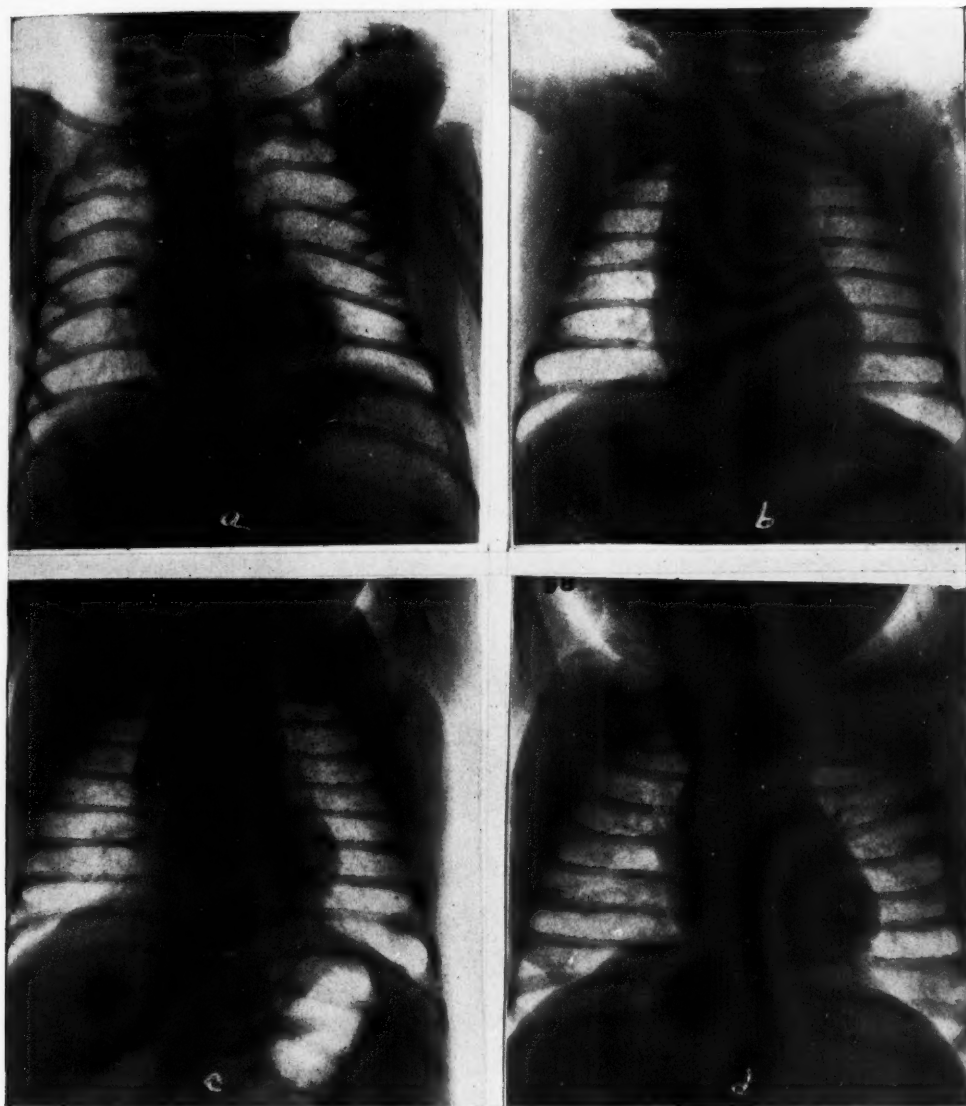


Fig. 12. Illustrating growth of thymus in same infant. (a) Two weeks; (b) One month; (c) Three months; (d) Six months of age.

cava forms the right border of the great vessels' shadow as they come off from the heart, and the pulmonary artery the left border. The pulmonary artery quickly divides into the right and left pulmonary arteries and in a number of our cases there was a patent ductus arteriosus. The aorta lies in the middle of the mediastinum and

in the infant at birth is not seen as a distinct shadow because of its position. It passes directly up and turns directly backward and passes down behind the heart. It is only in later life, as will be subsequently noted, that it forms the typical aortic arch as seen in adults. The comparative size of the aorta and pulmonary artery is very

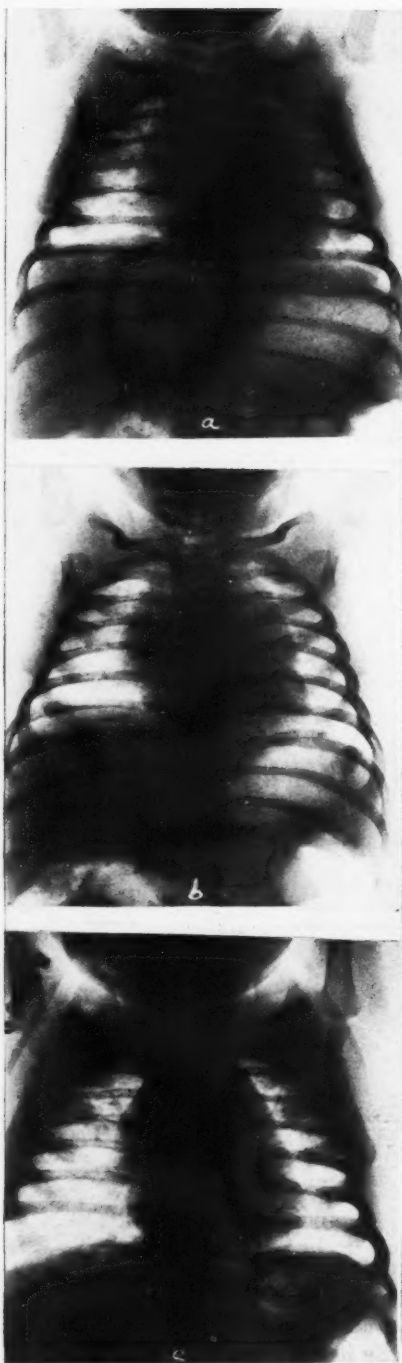


Fig. 13. Illustrating growth of thymus in infant with large thymus at birth. (a) Eight weeks; (b) Three months; (c) Four months. Note growth downward over heart.

nearly the same at birth. If then there is no sizable thymus present, these great vessels, *venæ cavæ*, aorta and pulmonary artery, form a shadow, triangular in shape, which quickly narrows as it passes upward towards the first rib, and at its narrowest point is less than the transverse diameter of the shadow of the spinal column. The trachea with its air column will be observed to pass down in midline behind the aorta and bifurcate at about the third thoracic vertebra into the right and left main bronchi. The esophagus, of course, lies behind the trachea but is not usually discernible. If the thymus is present in any considerable size, it will be found to overlap the base of the heart and to pass upward, obscuring the shadow, just described, of the great vessels. The shadow of this thymus is again triangular in shape, with its base overlapping the base of the heart and especially the auricles. Once having fixed firmly in one's mind the shadow cast by the base of the heart and great vessels and how the shadow of the great vessels rapidly narrows towards the first rib, the shadow of the thymus should be readily discernible. Its transverse diameter at its broadest point, which is usually the third interspace, may be two or three times the diameter of the shadow cast by the thoracic spine. This shadow of the thoracic spine is taken by measuring the transverse diameter of the vertebral bodies. If the shadow of the thymus is no greater than that cast by the great vessels, it is a very small thymus. The thymus lies anteriorly against the upper sternum and manubrium and posteriorly upon the auricles, great vessels and trachea. Laterally, it is overlapped by the anterior margins of the lungs and when fairly large pushes the lung to either side. Thus it will be noted that the thymus lies between a bony structure in front and a bony spine posteriorly, with the great vessels and trachea between the thymus and this posterior spine and only laterally and downward has it any chance to spread during its growth. It does so by pushing the anterior margin of the lung laterally and

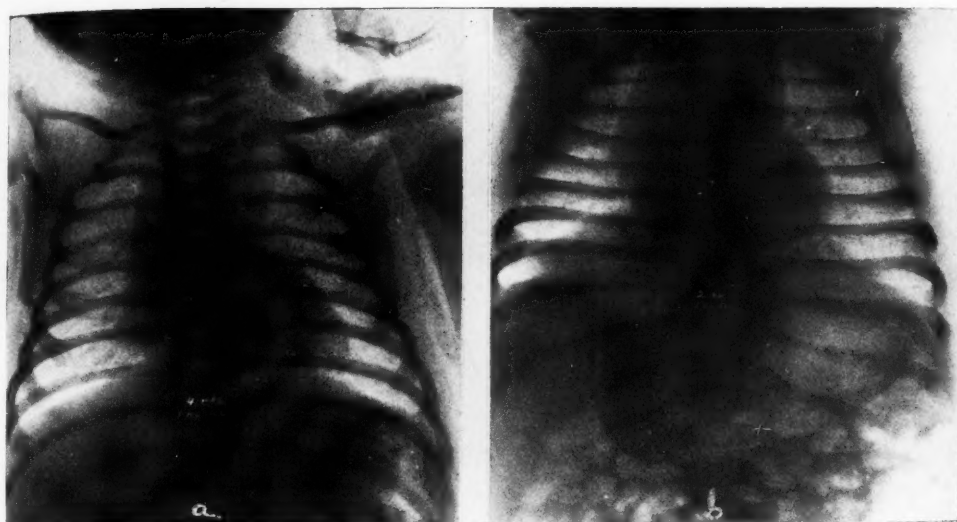


Fig. 14. Illustrating growth of thymus. (a) Four weeks; (b) Same infant, two months of age.

as these lateral lobes of the thymus are surrounded by the lung they are readily shown upon the radiograph. Some writers have described a large thymus which is large only in its anteroposterior diameter, but I have never seen such a one and cannot conceive of such a thymus except under unusual conditions. The thymus is a very soft, almost jelly-like gland and when removed and placed in the hand has a tendency to flatten out and when *in situ* it is not held by any definite firm tissue but has only the thin mediastinal pleura on either side and the firm bone structures in front and above and the great vessels and spine posteriorly. It must, therefore, grow laterally and downward over the heart. Upon inflation of the lungs, we found it very easy, by gradually increasing the pressure, to squeeze the thymus until the shadow was hardly perceptible in the anteroposterior position. This, of course, was due to the direct pressure exerted by the anterior margins of the lung upon the lateral lobes of the thymus. This phenomenon and the possibility of pressure in turn upon the trachea or the other mediastinal structures will require further study. At least this tends to favor the belief that we should take

our thymus radiographs, both at inspiration and expiration, in the recumbent position. Lying in the mediastinum, its lateral lobes will have a reflection of the pleura. The anteroposterior diameter of the thymus is that of the distance between the tracheal shadow and that of the manubrium and sternum. The parietal pleura is reflected from the midline of the sternum on the right and  $\frac{1}{2}$  cm. from midline on the left to surround the thymus and great vessels and to pass back to the spinal column, forming the lateral borders of the mediastinum. Its shadow, of course, blends in with the mediastinum and is not discernible. The right main bronchus, coming off from the trachea at level of the third thoracic vertebra, is recognized by its air column to pass into the hilus and it immediately divides into upper and lower main bronchi. These air columns may be seen to pass into their respective lobes and, at times, the thickness of the wall may be noted and measured. The upper bronchus, immediately upon entering the right upper lobe, divides into several bronchi, which accounts for the numerous shadows passing towards the periphery from the upper hilus. As the bronchus leaves the hilus in the upper

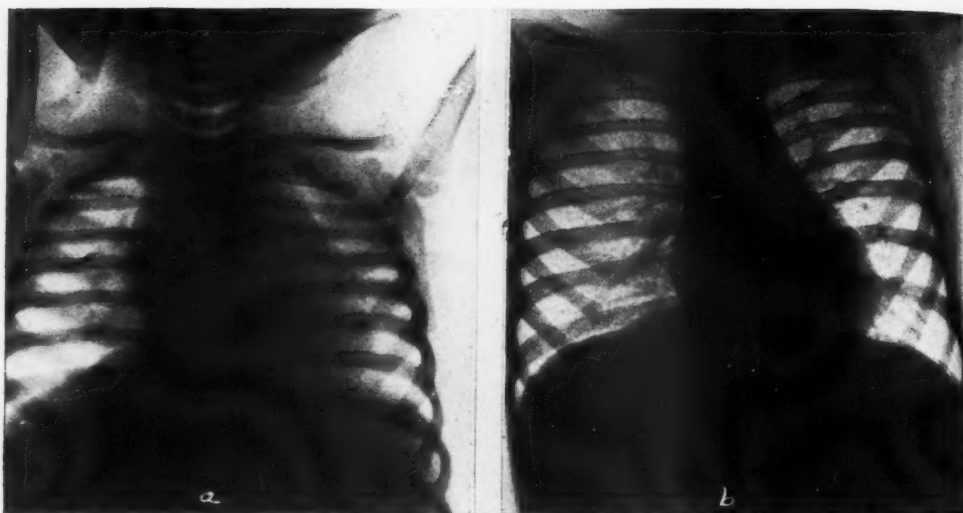


Fig. 15. Illustrating involution of thymus. (a) Ten months; (b) Same infant, 28 months of age.

lobe, it is followed along its lower border by an artery, while the vein lies above and to the inner side. The vein is not discernible upon the X-ray film but as we approach the hilus an increased shadow along the inferior and outer lateral walls of the bronchus is that cast by the artery. One can be sure of the bronchial shadow at all times if the air column inside the bronchus is visible, and, of course, the lateral edges of this shadow are that of the bronchial wall. Then if we know the thickness of the wall at any one point and compare this measurement with the measurement of the shadows shown on either side of the bronchial air column, it will tell us whether the shadow is due entirely to the wall of the bronchus or to a combination of the bronchial wall and artery. The right lower main bronchus, about  $1\frac{1}{2}$  cm. from the division of the right main bronchus, gives off a bronchus into the middle lobe. This bronchus then branches similarly to the upper main bronchus except that the artery lies above and to the lateral side and the vein below and to the inner side. The right lower main bronchus then passes on into the lower lobe, and, coursing through its middle, maintains a fairly heavy trunk to

the base of this lobe. The artery and vein have the same relation here to the bronchus as in the middle lobe. It will be noted that the right lower main bronchus and vessels form the largest shadow in the right chest, and, as it approaches the lower portion of hilus, the artery is seen to form the outer border of the hilus. The vein comes into the lower portion of the hilus but is not readily made out. The hilus is found, upon injection and by the studies made above, to consist of the bronchi, vessels and a small amount of connective tissue. There are no macroscopic lymphatic nodes present at birth and, of course, the nerves are not discernible. The hilus, therefore, is quite small and of fairly uniform density, with air columns passing through, representing the bronchi, and with a shadow coming into it from below on the outer side, representing the arteries. In any lobe the lobules surround the smaller bronchioli and may lie in close apposition to the larger bronchial trunks, and, while these lobules are not seen, they throw the bronchi and vessels into relief. These lobules also surround the hilus very closely, leaving only spaces for the passage of the bronchi and great vessels. The pleura and the septa

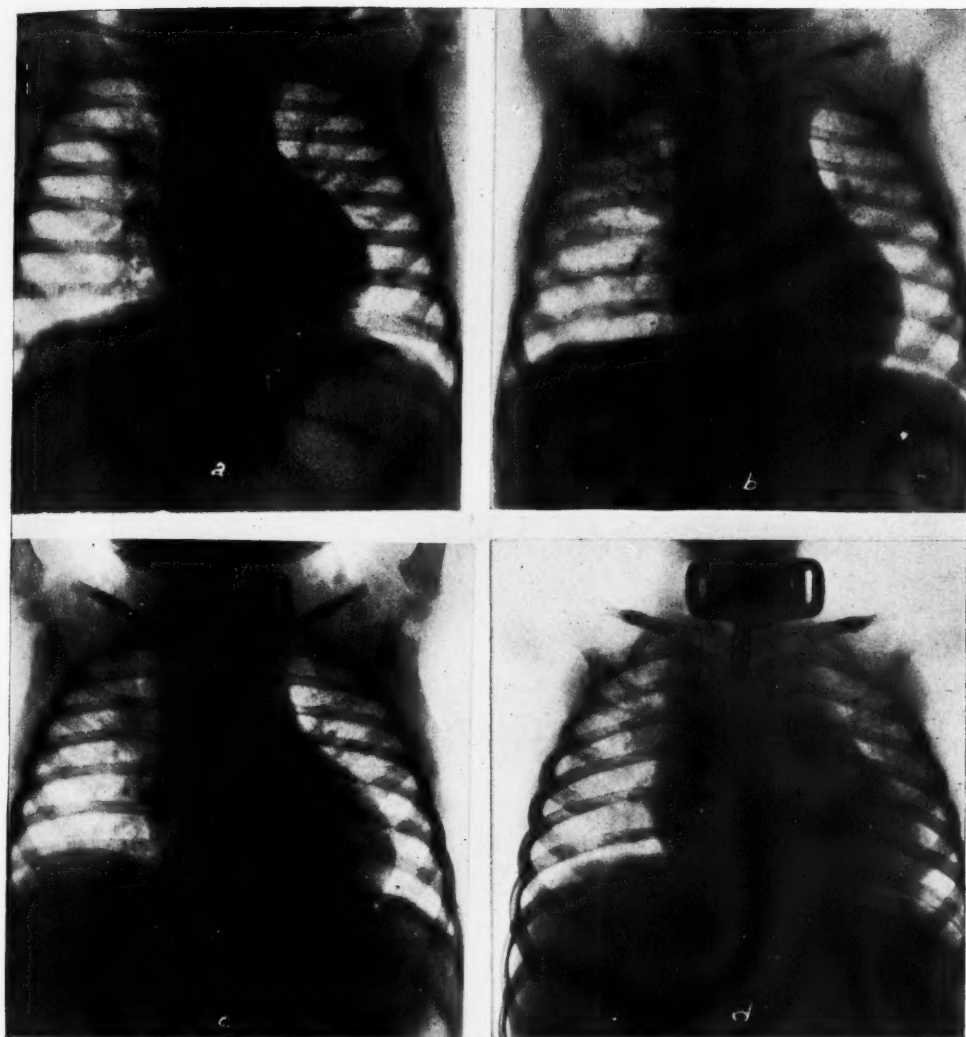


Fig. 16. Illustrating shadow cast by mediastinal infection from abscess of neck. Note extension out along bronchi from hili. (a), (b), (c), (d) are successive radiographs of same infant over a period of one month.

between the lobules are not seen upon the radiograph under usual conditions, in infants. Therefore, the parenchyma of the lung, meaning the lobules, is clear and of uniform negative density. The bronchi, with their tiny air columns, may be traced well out into the periphery of the lung. These linear markings, artery and bronchus, are smooth, not beaded, unless by chance there is a single node here and there

cast by a bronchial cartilage, as spoken of by Miller, and the artery may be readily distinguished from the bronchus. He has also described small annular shadows cast by an end view of a bronchus or by bronchial cartilages. I have been able to verify this on some of my films and, in addition, have seen a node cast by the overlapping of an artery at its bifurcation. In other words,

at the point of bifurcation the artery is somewhat larger if the measurement is taken through the two arteries at the point of bifurcation. Any one of these nodes, as here described, is single, the nodes are

there is no bronchus given off to a middle lobe. The appearance of the shadows on this side is otherwise similar to the right. In both the right and left lungs the arteries cast much the denser shadow, but it is

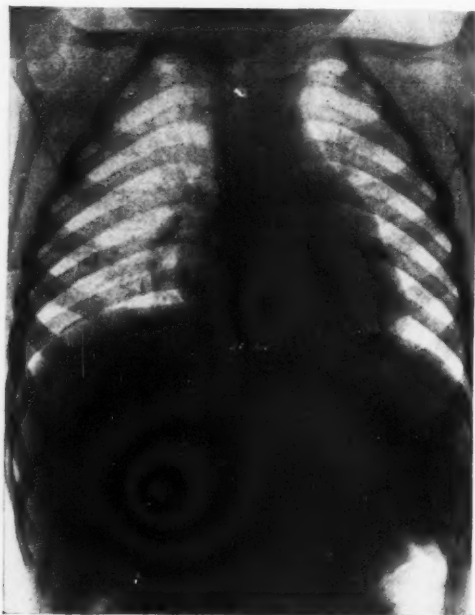


Fig. 17. Child 26 months of age and normal from every examination.

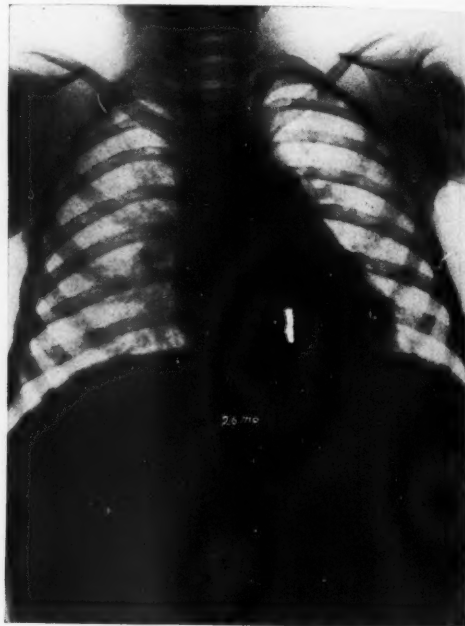


Fig. 18. Child 26 months of age, below average weight, quite nervous, and having positive Von Pirquet. Compare with Figure 17.

few in number, and at all times cast a distinct shadow, and should not be confused with the congestion of the lymph nodes or mottling. In other words, there are no macroscopic lymphatic nodes seen at birth or in very young infants. The connective tissue surrounding the bronchi and blood vessels, I shall discuss later.

Turning now to the left lung, we see the air column of the left bronchus passing to the left, but do not notice that it passes beneath the arch of the aorta. The hilus has a similar appearance to the right with, again, the artery forming the outer border. The situation in the upper lobe is similar to that on the right except that the artery lies above and on the inner side of the bronchus. The condition in the lower lobe is similar to that on the right with the exception that

slightly smaller in diameter than the bronchial shadow. As mentioned above, I have not been able to clearly delineate the vein which nearly always follows an independent course. In other words, the linear markings in the infant are composed of an artery, a bronchus, at times a vein, and considerable connective tissue, and in any well taken film we should be able to differentiate and study the artery, a bronchus and surrounding tissues. There should be no question in the radiologist's mind as to their identity and his ability to trace them from the hilus even to the fairly small divisions.

The ribs assume different positions but usually the transverse one at full inspiration, as described in the birth series mentioned before. The diaphragm may as-

some shapes from a fairly well-rounded shadow to that of a cone. Such is the anatomy, as I have been able to identify it with the shadows on the radiograph at birth.

From postmortem observations, I find things both in accord and at variance with

postmortem studies and in the series of studies. This is in accordance with LeBoutillier's observations, referred to by Pearce in 1919. I have observed a large thymus disappear under a wasting disease and, again, have seen a baby with a small thy-

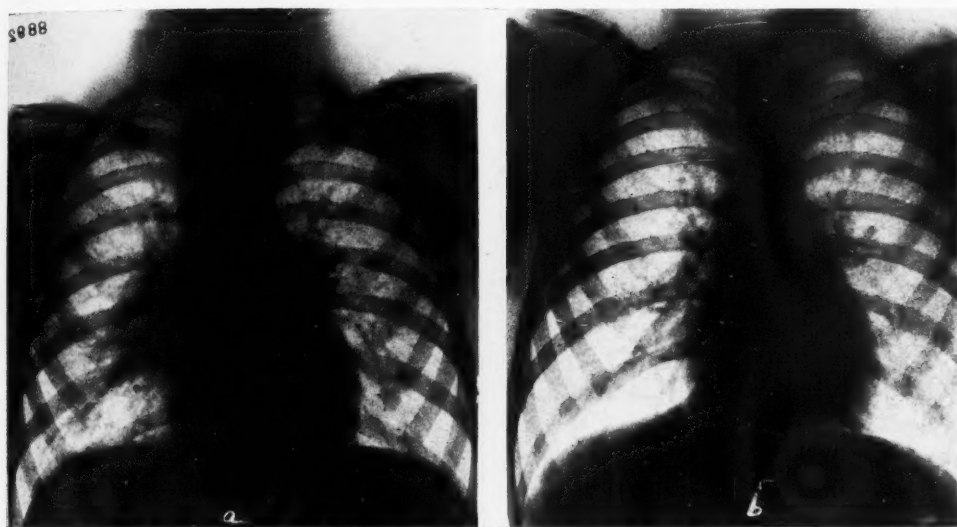


Fig. 19. (a) Child five years old with early pulmonary tuberculosis. (b) Same case two years and nine months later.

the general medical opinion. The heart, of course, gradually increases in size and the great vessels keep pace with it, the aorta probably assuming a greater growth than the pulmonary artery. The lungs also increase in size and the bronchi and arteries supplying the various lobes must also increase in size to supply the lobes. The right lower bronchus at birth on an average measures  $3\frac{1}{2}$  mms. and the left lower 3 mms., and these steadily increase, keeping about the same relation of size to each other. The artery supplying the right lower lobe measures  $2\frac{1}{2}$  mms. at birth and at four years of age measures about 6 mms. The vein supplying the right lower lobe measures 6 mms. at two months. The right and left main bronchi measure 6 mms. and 5 mms. at birth and increase until they measure 9 mms. and  $7\frac{1}{2}$  mms., respectively, at four years of age. The thymus is found to vary considerably, both in my

mus at birth die suddenly at twenty-six months with an enlarged thymus. I shall speak further in regard to the thymus. The ribs are quite interesting in their change of size and shape during the growth of the child, and this will be reported upon later by Dr. Waring.

In the descriptions and discussions of radiographs of chests at any age there is nothing that receives as much consideration and attention and also excites so much debate as fibrous tissue. Unfortunately, though connective tissue readily shows on a radiograph, it is quite difficult to differentiate between connective tissue from normal physiological changes and that of fibrous tissue from pathological changes. It, therefore, becomes very necessary that careful observations be made upon connective tissue in the lung of the infant at birth and as to what changes take place as the child grows to adult life. As the right

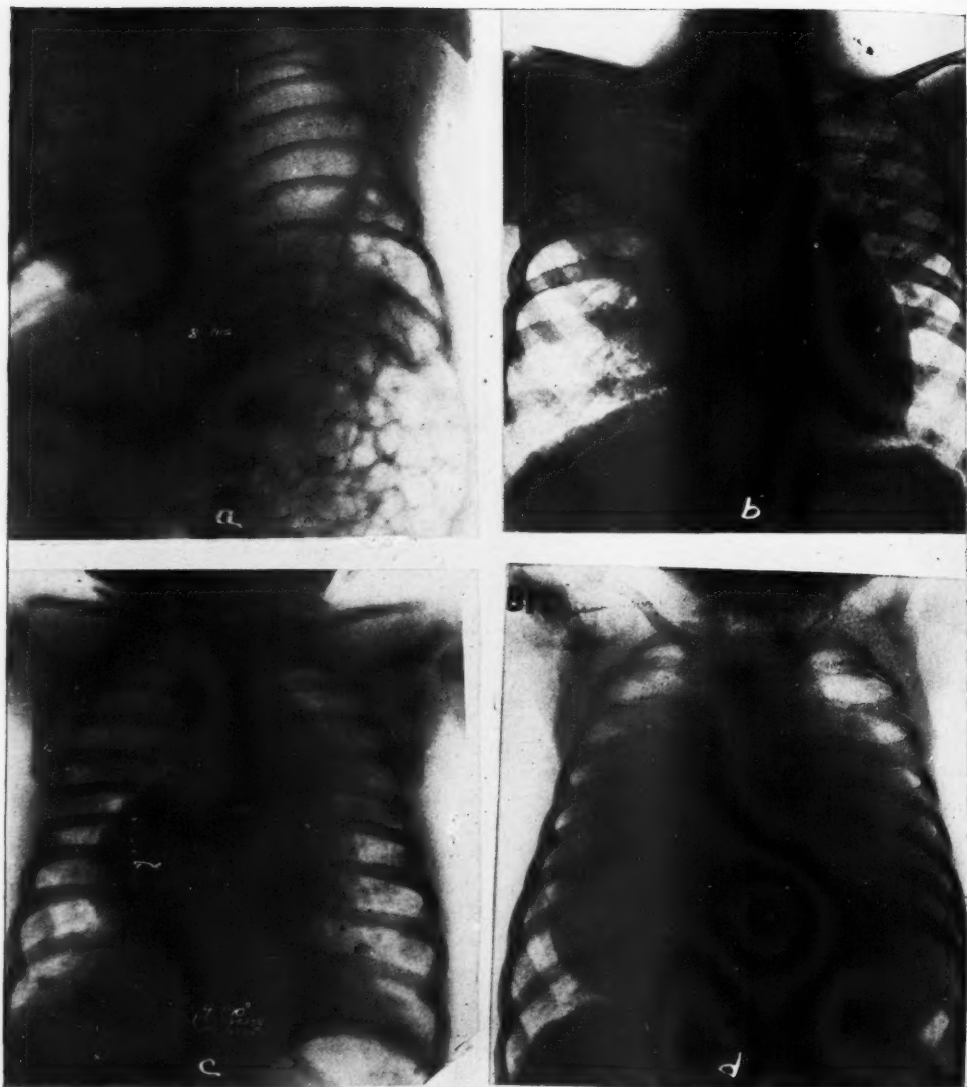


Fig. 20. (a) Infant eight hours old, with congenital hernia of diaphragm, stomach in left chest and heart on right. (b) Congestion of lungs from heart, with some pneumonic areas in upper. (c) Transposed thoracic viscera, with congestion of lungs. (d) Congenital heart.

lower main bronchus is one of the most prominent of the lung markings, let us give it careful consideration. As noted above in our postmortems, the right lower bronchus measures  $3\frac{1}{2}$  mms. at birth and 6 mms. at four years of age and the artery lying alongside makes a corresponding gain in growth. It is also noted on dissection

that these form a considerable trunk, passing from the lower portion of the right hilus to the right lower lobe, and as the bronchus and its vessels pass into the right lower lobe it does so in a fairly well-circumscribed area. It is also noted that as these come out of the hilus they carry with them certain connective tissue which holds them

together and gives them support. It is also observed that the main bronchus maintains a fairly definite course through the right lower lobe and, as it is accompanied by its artery, it is still surrounded by a certain amount of connective tissue. As this bronchus and artery increase in size, the connective tissue must also increase in quantity to give these structures the proper support. This is definitely borne out on dissection of specimens. I fancy also that there must be an increase in the growth of connective tissue as a result of use, similar to connective tissue growth in any other part of the body as a result of use. Certainly as the diaphragm descends and raises during inspiration and expiration and during the act of coughing, there must be considerable tension thrown upon the right lower lobe (this, of course, would hold true to greater or lesser extent for any of the lobes) and its support from the right hilus. Dr. Miller, in his description of the connective tissue of the lung, speaks of collagenous fibers designed to take care of the various strains and elastic fibers designed for elasticity. There is still a third change in the connective tissue which we must consider as distinctly normal but which is not noted to more than a moderate extent in very young children, and that is the increase in connective tissue as a result of age. A boy fifteen years of age would have a great deal more connective tissue than an infant just born and a man seventy years of age more than a boy of fifteen. This is seen daily upon radiographs and is in keeping with our knowledge of the general bodily tissue. The connective tissue change as a result of dust inhalation and inflammatory processes is quite interesting. In our post-mortems, we have observed markings upon the septa, quite appreciable at two months of age and becoming a great deal more marked at four years of age. In cities with more smoke and dust, this should be much aggravated and is a cause for slight increase in fibrous tissue, and becomes more marked from year to year. As these dust particles are carried from

the air cells along the lymphatics to the hili, we then expect a slight increase in fibrous tissue along the bronchial trunks. The inflammatory diseases are apt to leave bands of fibrous tissue or increase of connective tissue growth along the already present connective tissue strands about the bronchi and arteries, but I feel that these must be considered as a normal process, if they are not congested and are producing no disturbance from their mere presence. These observations with regard to connective tissue changes are applicable to the various parts of the thoracic viscera. Thus, the mediastinum becomes stronger, firmer, and broader, to support the important structures within, and no doubt undergoes the same changes just noted. It is an interesting observation that this mediastinum above the heart maintains during growth a fairly definite relation in its transverse diameter to the transverse diameter of the spinal column. This is, of course, explained by the corresponding growth in the spinal column.

The next change which is given an important place by radiologists is the lymphatic tissue. In my own work, I place the changes in the lymphatic tissue first and the connective tissue second, feeling that the lymphatic changes are more apt to be the result of infection. In our post-mortems, we have found no macroscopic nodes present in the hili or out in the lung proper at birth and not until four years of age did we find lymphatic nodes which might be considered as a normal physiological change. These were about the hili and were so small, 2 mms. to 6 mms. in diameter, that they did not show upon the radiograph after the lung was removed and inflated. This accounts for the uniform densities of the shadows cast by the bronchi and vessels in the parenchyma of the lung and the hili. These observations are in accordance with Dr. Miller's on lymphoid tissue. It would then seem that any lymphoid increase between birth and four years of age would be pathological unless it had undergone fibrosis or calcification.

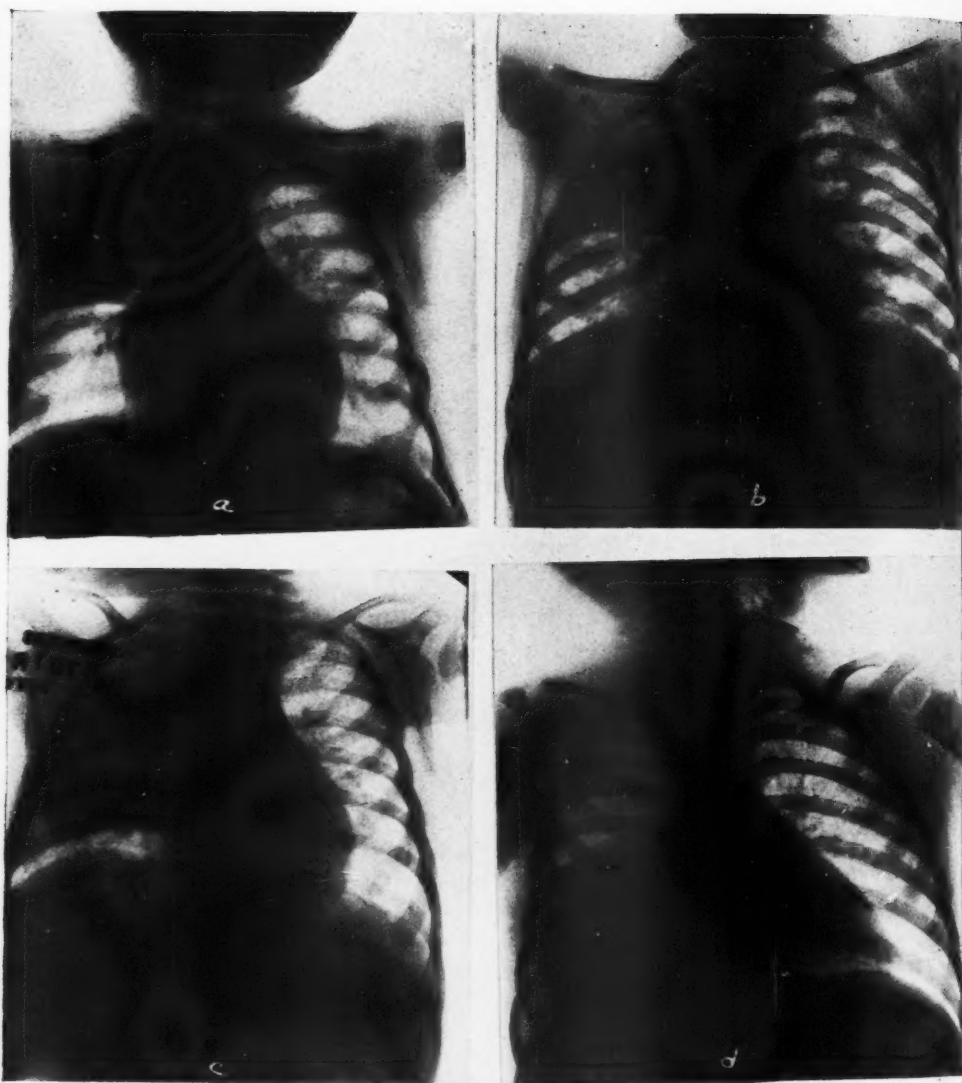


Fig. 21. (a), (c), (d) Lobar pneumonia; (b) Lobar and broncho-pneumonia.

Glands of any size in the hili, or lymphatic nodes of very small size along the bronchi, are observed to show upon the radiograph.

It is important to know how gross pathology must be before it will show upon the radiograph. It is my opinion that pathology shows more readily than is generally recognized. The infant's chest responds very quickly to inflammatory processes, which will show considerably upon the

radiograph when nothing is revealed by a physical finding. This is in keeping with the clinical observation. We have tried to verify our radiographic shadows with microscopical studies and find that congestion of the air cells, either as a result of infection or of passive congestion, is readily seen, even when only a small pathological change is present. We have thus seen very tiny patches of broncho-pneumonia,

following whooping cough, casting very distinct shadows about the hili and bronchi. The passive congestion, on the other hand, is apt to lie furthest from the bronchi, and this may be a distinguishing feature. The connective tissue changes also quickly show, and in fairly small amounts, either along the bronchi and vessels or, in more marked cases, extending out along the septa between the lobules. As noted above, the lymphoid changes along the bronchi are quite readily seen, but in the hili the lymphatic nodes must be larger, perhaps at least one-half to one centimeter in diameter, before being noted. It is also necessary that the lymphoid tissue must assume a greater density than its surrounding tissue before it can be seen. This latter point accounts for our inability to recognize various changes in lymphoid tissue unless this tissue, by chance, is well surrounded by air cells and not other connective tissue. Certainly, early giant cells will not show until they have become macroscopic, and I have observed a considerable seeding of these, as seen with the microscope, which were not macroscopic. At this point let us make it clear that we have not found macroscopic lymphatic nodes at the hili normally, at least in our series under four years of age, and if any such are large enough to be shown upon the radiograph they should be given careful consideration. Such a gland, unless it be calcified or distinctly fibrous, must be considered pathological, the same as a congested gland in any other part of the body, and we must accordingly endeavor to find the source of infection, just as we do in congested glands in other parts of the body. Such a gland, although single, may be the very one to become caseous and produce a miliary tuberculosis. Beside the hilus proper, one should search for these glands just beyond its limits where the larger bronchi enter, or, still further, out where the main bronchus begins to break up into its subdivisions. This is especially noticeable where the main bronchi from the upper lobes gather to form the upper main bronchus.

Acute congestion of the bronchi was not found to be discernible unless the acute process tends to extend beyond the mucous membrane or even beyond the bronchial wall. The pathological changes in the thymus should not be overlooked. Our observations then lead us to feel that congestion in the parenchyma is the most easily shown on the radiograph, while the changes in the lymphoid and connective tissue are much less so. On the whole, the radiographic findings correspond closely to postmortem and clinical history. The greatest difficulty was my inability to recognize pathological changes, as such, although these changes were quite evident when reviewing the radiograph after the postmortem study.

If we are able to accept the foregoing postmortem experiments and especially the identification of the living anatomy with the shadows seen upon the radiograph, we should then be in a position to study radiographs of the chest. This postmortem work has shown that we are able to portray quite accurately the heart and mediastinum and the thymus. By a closer application we are able to study the hili and the bronchi and arteries leading out from the hili. This is especially true of the larger bronchi and arteries. The smaller divisions are seen to lead to the periphery, even in the normal case, and we were not able to differentiate in these smallest divisions between the arteries and bronchi. Any appreciable change in connective tissue or lymphatic tissue should also be shown. The parenchyma is seen only as a clear negative density unless pathology be present. The chest wall and diaphragm may be easily seen. Let us now take up the series of infants on whom we have radiographs of the chest from birth to three years of age.

At this time, I do not care to note the shadow of the heart further than to call attention to the fact that the shadow cast by the base of the heart and great vessels is triangular in shape and rapidly narrows until at the second rib it is equal to or slightly less in its transverse diameter than

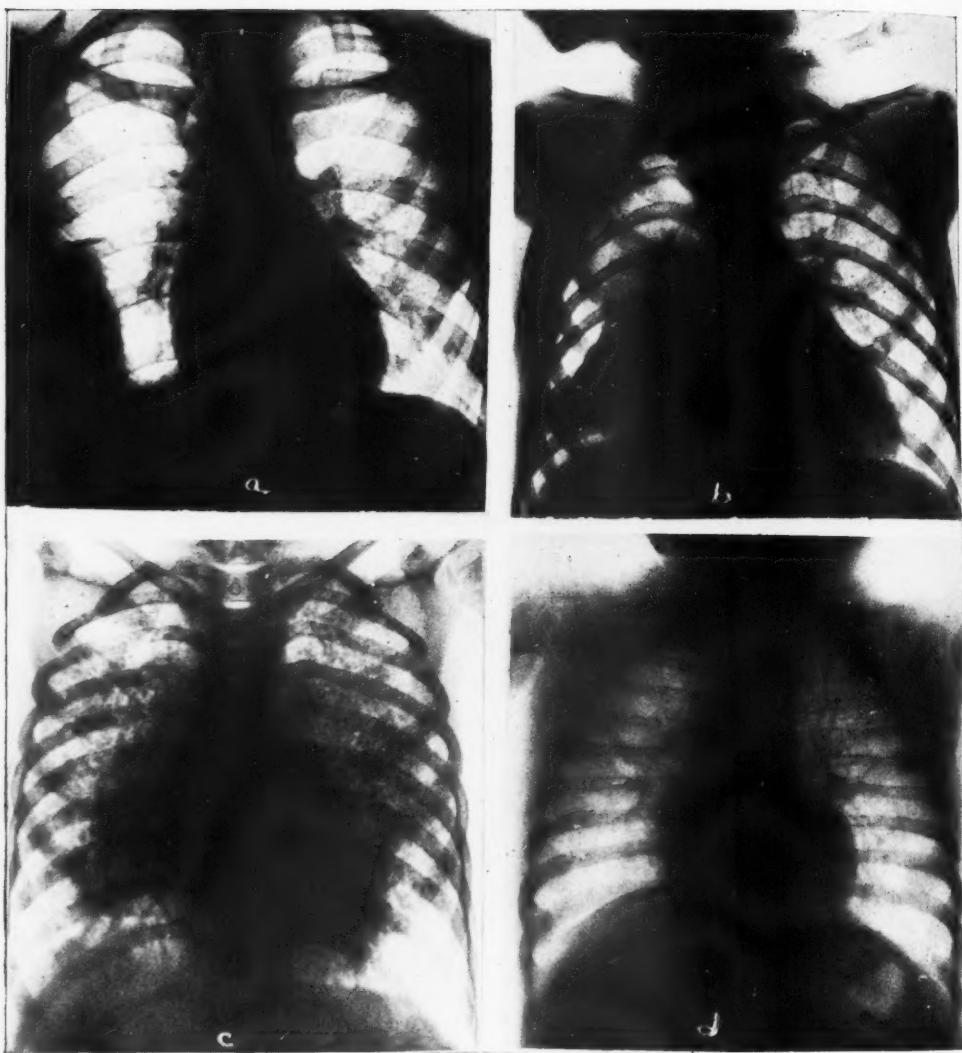


Fig. 22. (a) Sarcoma of rib involving lung. Age 13 years. (b) Spontaneous pneumothorax in child 7 years of age. (c) Miliary tuberculosis. Age 12 years. (d) Bronchitis. Age three and one-half months.

that of the thoracic spine, and carries this diameter fairly uniformly to the first rib and clavicle. At three years of age the aorta is still not discernible as a distinct shadow in the anteroposterior direction.

As previously stated, I have found the thymus quite variable in its incidence, size and disappearance. I do not wish to enter too deeply into the discussion of the thymus at this time further than to say that it is of

frequent occurrence, disappears at varying ages, may be small at birth only to show as a large thymus two months later. This growth may take place during the first few months after birth or many months after birth. As an average, however, I find that the thymus begins to grow immediately after birth and continues its growth until about one year of age. It then begins to decrease in size until, at 26 to 28 months,

there is no appreciable thymus present. This cycle of the thymus, as I have called it, will require further study before reporting in detail. I have made an arbitrary classification of the size of the thymus into three classes. The first is the small thymus which is not increasing the transverse diameter of the mediastinal shadow or, in other words, is only one-third greater than the width of the bodies of the spine in the second interspace. The second class is a moderate sized thymus where it is twice the diameter of the body of the thoracic vertebra in the second or third interspace. The third class is one where the thymus is three or more times the width of the thoracic vertebra, or the large thymus. It would seem that this class should not be operated on. I feel that such a series as we are following will throw considerable light on this much-discussed question, and we shall report more fully at another time.

In turning now to a discussion of the changes we see in the hili and the shadows cast along and by the bronchi and arteries, we find that we are dealing with a very difficult and delicate situation. The appearance of the radiograph changes so rapidly and completely at the varying ages that it is next to impossible to carry in one's mind a true conception of what should be the normal chest. It is necessary to view the series as a whole to get the correct conception of the situation, to view frequently, and to keep the varying ages at hand in making comparisons. We have endeavored to select from among our series of fifty-six babies, certain children from good environment, non-infected families, children with negative Von Pirquets, and with negative clinical histories, as a basis for our comparative study. Such a child is usually robust, is not subject to frequent nose and throat infections, and has had no evidence of disease over the period of time we have had it under observation. Where a child has had any illness, we have endeavored to get radiographs at the onset and termination of the disease, and make due allow-

ance for such illness and any other observation possible.

As we view a series of radiographs from birth to three years of age, the most striking thing is the extreme prominence of the hili, the bronchi and vessels. Even at birth, these linear markings, occasioned by the structures just mentioned above, may be traced to the periphery and stand out in considerable relief. This may be partly due to the apparent disproportion between the total quantity of these structures and the parenchyma. As the baby grows, so these structures grow and retain their prominence. The hili broaden, the bronchi and arteries increasing in diameter. It is observed that frequently at two to four months most children show small increased densities along the larger linear markings and about the hili, which might be attributed to lymphatic tissue. In other cases, we even see a tendency to congestion of portions of the parenchyma, with an increased density of the linear markings of the periphery. Many of our babies had evidence of nose and throat infections at this time and it may be possible that these shadows in the chest have to do with some of the earliest infections. It is impossible to conceive of taking a baby from its sterile environment *in utero* and placing it in the dust-laden atmosphere of our present life and in some cases allowing it to breathe the cold air, without expecting it to show some evidence of reaction to this change in environment. At least some of these markings have persisted and these children have shown a tendency to malnutrition and have not overcome this until twenty months to thirty months of age. In other words, we have observed that these shadows begin to disappear in some of our cases at twenty to thirty months of age, with an improvement in the general condition of the child. It is also interesting to observe that many of these children who seem below par and have suspicious chest markings, a little later show a positive Von Pirquet. I have then asked myself the question, "Are these changes just mentioned evidence of pathol-

ogy, and, if so, is it the evidence of some incipient disease, such as tuberculosis, or merely the temporary inflammatory processes we might expect from the environmental changes the baby undergoes early in life?" Unquestionably, we will need considerably more evidence to decide this question, but I am convinced that some of these changes in certain babies have been evidence of infection and that this infection is of a more or less chronic nature. Comparisons with special cases showing more definite pathology make it appear that some of these changes just mentioned are the beginning shadows of lymphatic tissue which may become more prominent later in life. It is worthy of note that the close scrutiny of such radiographs as we have been attempting to describe makes it comparatively easy to recognize pathology in other cases where there is definite clinical evidence of disease, without laboratory or physical findings. It would then be our observation that we may expect the linear markings of the infant's chest to retain their prominence, but they should be of uniform density, both as to the hili and the bronchi, and should not become too prominent in the smaller subdivisions of the bronchial system. In case these changes do take place and there is evidence pointing to lymphatic tissue, it should be viewed in the light of possible infection and given its proper consideration.

The parenchyma of the lung I have found to be clear in its normal condition and the only markings that it may have normally are those of some of the smaller bronchioli. The pathological changes occur very readily and are also quite easily seen upon the radiograph, either in the form of congestion or of fibrous tissue.

As previously noted, the diaphragm which closes the bottom of our thoracic cylinder assumes varying shapes peculiar to an individual. These shapes vary from a rather flat diaphragm to a quite rounded or even a conical one. These conical diaphragms are especially noted in the young infant during the first few weeks of life.

It is interesting to note that the general shape of the diaphragm of the younger child seems to be fairly well maintained throughout our series of any child. It is likewise interesting to see the tremendous slope posteriorly from the dome of the diaphragm down to its posterior attachment along the spine and ribs. There is a considerable portion of the lung in this space, hidden by the diaphragm and liver, in which it is difficult to demonstrate pathology. Hernias of the diaphragm, even in the youngest infant, may be detected by knowledge of the stomach and chest, as described in our "birth" series. We have been able to portray such a condition eight hours after birth. The ribs forming the sides of our thoracic cylinder assume, on inspiration, varying positions after birth, from acute angles to an exaggerated right angle position, within the first two weeks after birth, and then, later in life, assume the more adult shape. Dr. Waring is giving this special study and will make a report upon it. I have thought that the exaggerated right angle position soon after birth had something to do with the child's effort to completely expand its lungs and clear any atelectatic areas which it may have at this time. The absence of this position may sometimes call attention to weakness on the part of the child or some definite pathology within the chest. We have noted nothing unusual in this series with regard to the pleura, although in our special cases we have seen involvement of the pleura, but it is our conclusion that the pleura normally casts no distinctive shadow.

We have carried out the plan of radiographing the nasal accessory sinuses in our babies, watching the growth and development, the infection of the sinuses, and the effect, if any, on the thoracic structures. In our series from birth to three years of age, we have repeatedly observed a coincident infection of the sinuses at the time when there is also an infection of the lungs, but as yet we are unwilling to say as to the effect of this sinus infection

upon the lungs or the further development of the sinuses. Dr. Carmody will make this report.

The study of the Von Pirquet test, along with our series, which Dr. Waring is making, is proving of considerable interest. We have been able to prophesy in a high percentage of our cases as to when this Von Pirquet should be positive, and in following our children, through watching the changes upon the radiograph, the question has arisen in my mind as to how long the child must carry a tubercular infection and as to what quantity it must have before the Von Pirquet will become positive. In some cases, we have insisted upon a check Von Pirquet when it has been negative and the radiograph was suspicious and have found that the Von Pirquet was occasionally positive. Certainly, there must be many factors to vary this finding.

The physical findings of the lungs or thymus are negative unless there is considerable pathology present. On none of our cases, even when the radiograph showed rather marked changes, did we find anything in the physical findings to indicate there was trouble. The heart, on the other hand, reveals its presence and condition much more readily to percussion and auscultation. The radiograph is quite an aid in determining the position and enlargement of the whole heart or any of its parts.

As previously stated, the infants we are studying have varying family histories and represent all classes of society. It should prove to be an interesting study in itself to follow up the babies with so-called negative family histories and make comparisons from every angle with those of definite tuberculous parents. We have a number of infants, both parents of whom are advanced tuberculars and some afflicted with other diseases. In the cases with tuberculous histories, with few exceptions, these infants show questionable pathology on the radiographs as early as the second month, these findings being substantiated a little later with positive Von Pirquet reactions. Several babies of this class were removed

from their parents when a few weeks of age, were not breast-fed, and now, at ages varying from twenty-two months to three years, have negative Von Pirquets, showing, however, increased markings upon the radiographs. In every case of a positive Von Pirquet, followed by proper measures as to treatment and care, the child has shown marked gain within a few weeks' time. It is not a new idea to add that environmental conditions and habits reflect not only upon the faces of the young, but to a marked degree upon their chests. In families where there is the need, by helping them towards better living, we feel assured of beneficial results in the young.

In making comparisons of one series with another or any one age with another age of the same series, one is impressed with the importance of the technic and the difficulty in studying the minute changes that are shown. In many cases, the slightest evidence of a suspicious shadow at a few months of age will become quite prominent a little later. This is the reason for not only a uniform technic but one showing the greatest detail. It also brings us again to face the problem of the early incidence of certain shadows which we think of as pathological later in life. Certainly, the average child carries considerable pulmonary infection, beginning early in life and through his first few years, and we must be wary about passing this by as a normal finding when a radiograph taken a few months later would show it to have spread astonishingly.

Having reviewed our series of fifty-six babies, let us now turn to a series of cases selected at random to illustrate the various diseases of the child chest. One is immediately impressed with the difference between pneumonia, broncho-pneumonia, miliary tuberculosis, bronchitis, etc., when seen in their typical forms. And when these diseases are seen, each in its typical form, they are not especially different from those seen in the adult chest. We do not have the handicap in the young child, however, of the tremendous amount of fibrous

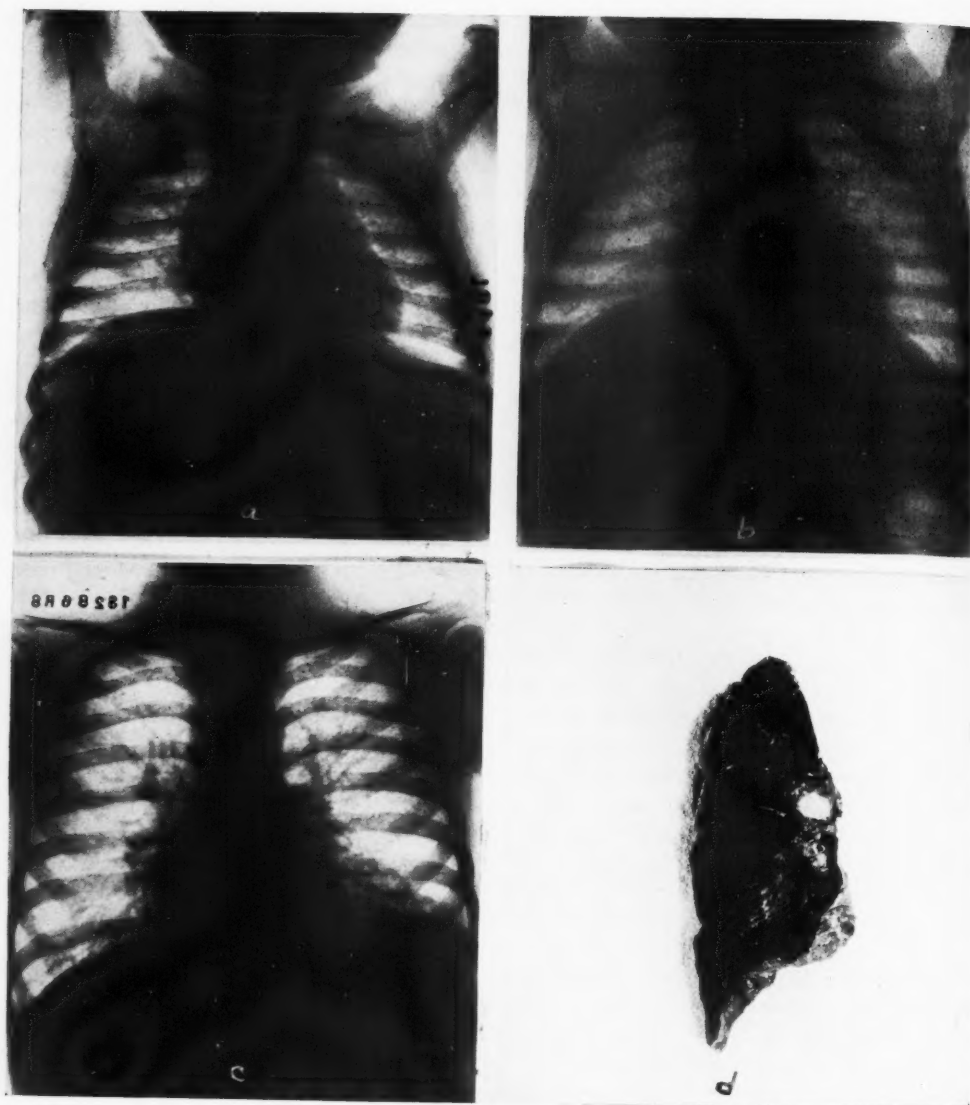


Fig. 23. (a) Large thymus, with considerable bronchial congestion. (b) Infant at eight months, with bronchial congestion. (c) Child four and one-half years, with advanced bronchiectasis. (d) Cross-section of lung of child four years of age, with caseous gland at hilus.

tissue, calcified or fibrous glands, that indicate a life history, as we do in the adult. In other words, whatever we see in the child is more apt to be present activity rather than the result of previous activity. Unquestionably, we may have more fulminant types in children and infants than we do in adults, but certainly there is a great

resemblance between typical types of disease in the adult and child as seen on the radiograph, and they are easy of diagnosis. However, when we turn to the atypical forms or to the earliest evidence of disease our problems are immediately multiplied, and it requires shrewd observation to keep us from being misled. This, however, may

be said of the diagnosis of the adult chest in atypical or incipient forms of disease, or of the internist in making his summary of similar cases. What pathologist does not often insist upon waiting to place his sections of the lung under the microscope before rendering an opinion? In other words, the radiologist, like the internist, would do well to keep the case under observation and make subsequent radiographs before being too definite in the atypical forms.

If we now take up a series of borderline cases and compare them with our series of fifty-six children, on the one hand, and with our series illustrating typical forms of advanced chest diseases, on the other hand, we are impressed with the importance of the early markings and the difference in the reaction of the tissue between the borderline and the typical cases. In the borderline cases, there are probably many factors that cause them to be borderline cases, such as atypical forms of the organism itself. Again, we may have a mixture of organisms, each producing its typical form of pathology, but one overshadowing the other on the radiograph until the diagnosis is likewise obscured. Let us not forget that the lungs have an outside communication with the air and its contaminations and irritations, that all of the blood in the body must pass through the lungs some time or other, and that the lungs are connected directly with the lymphatic system of the head and of the abdomen, and, as a result of this unusual anatomical relation, they have a wide variety of disease conditions. The better technic that we have, and, as a result, clearer radiographs, more accurately depicting the pathology shown, the less complicated is our diagnosis in the borderline cases. Frequently, this type of case is just the beginning of a more typical form and has not as yet assumed those cardinal characteristics. In comparing back with our series of fifty-six babies, one can almost see the space bridged between the two and certainly they show what we may expect a little later in some of our cases.

These borderline cases sometimes do the unexpected, and it is not well to have too many dogmatic ideas upon the subject at the present time. Certainly, it is not advisable to pass lightly any evidence of pathology in the infant chest, as is illustrated by the case of miliary tuberculosis from a single caseous gland at the hilus, mentioned in the discussion of our postmortem material. Many other cases of similar nature could be cited where we have watched an obscure and only slightly probable lesion develop into very definite pathology.

If I have in this paper shown that there is a practical technic for the routine radiography of the infant chest and by the postmortem work that I am showing the anatomy of the infant lung, and if by our study of the three series of cases have shown that there are differences in the diseases of the infant lung and if by all this combined work I have shown that these diseases may be portrayed upon the radiographic film, then certain conclusions may be drawn. It is quite evident that if all this be true then we have a method of studying the early origin and incidence of diseases of the chest and their future progress or retrogression. It also gives us a method of studying any child and his changes from year to year, changes which are never-ending and constitute what I have been pleased to call the "progression of the chest." Such a study must be the basis, not only for the knowledge of the infant and child chest, but the real foundation upon which we must build the superstructure of the adult chest. Necessarily, it requires a period of years of close application and perseverance and necessarily it will require the study of such series by many men, to arrive at final conclusions. It seems impossible that any radiologist could have a very intimate acquaintance with the pulmonary structures without such study, and its possibilities for the general good are very great. An early diagnosis and the instigation of suitable measures for recovery mean a healthier child and a stronger adult and fewer cases of the chronic form of pulmonary diseases.

In our short period of four years, we have already seen such gratifying results, not only in our series of children three or four years of age, but in special cases of children five or six years of age, or ten years of age, where we have utilized the knowledge gained. I cannot help but feel that we have seen sufficiently gratifying results to make it quite certain that when such methods have by more general application by the medical profession been made accessible to the public, such results will be the usual occurrence. No doubt, there will be countless mistakes, as in any new medical procedure, but the final results should overshadow these and tend towards the general good.

#### DISCUSSION

DR. JOHN D. MACRAE (Asheville, N. C.): I have never listened to a paper which gave me more pleasure. Since my work has been largely connected with the examination of lungs, and since I knew Dr. Wasson's work which had already been started, I felt on coming here that I was going to listen to something that would be of great value to me, and I am not disappointed. It is true that pediatricians are now using X-rays to help them in the study of their children's cases more than they have done in the past, but it is equally true that they are not giving the X-ray man a chance to help them as far as he can. Dr. Wasson's paper will be of the greatest use to radiologists in pointing the way. It is original work and it is being done in a most exhaustive way. The estimation of the value of shadows in a child's lung diagnosis is far more difficult than in the adult lung, chiefly because our attention has not been centered on these shadows.

There are many technical difficulties which Dr. Wasson has overcome wonderfully well, but radiologists as a class have not centered their minds on the study of the infant lung; consequently there are tremendous discrepancies in their interpretation of their radiographs. How many times

the average sized hilum shadows as portrayed in an X-ray film are referred to as representing disease. How many times the dense shadows of lymph nodes later on are pointed to as being incontrovertible evidence of tuberculosis. The recognition of the enlarged thymus and this remarkable demonstration of the thymic cycle are outstanding things in his paper. There is a feeling that calcification means inevitably an old tubercular lesion when recognized in the lymph nodes at the root of the lung—I would like Dr. Wasson to give us his impression on this matter. My own impressions in that particular respect are that a good many times the hilus nodes become calcified from infectious processes other than tuberculosis. The valuation of the shadows which radiate from the hili—we are helped by this paper in that measure. Connective tissue is made to proliferate and become denser and more massive by reason of dust inhalation and by reason of infection and the thick trunks radiating from the hili are frequently the result of comparatively innocent pathological processes, irritations rather than tubercular infections.

The carrying on of this study from infancy to the age of an adult must inevitably be a study that will be epoch-making in our field. I can only refer to some of the things which he has said that make his paper of extreme value to me. I cannot take issue with him on anything, and I shall look for his further studies, and when his paper is published it will be on my desk as a work of reference. I thank Dr. Wasson for it.

DR. I. S. TROSTLER (Chicago): I think we owe an immeasurable debt of gratitude to Dr. Wasson for his presentation. I have had the opportunity of seeing some of his work and trying to follow it in a very meager sort of way, in Chicago, but never, of course, did I attain the ability to do the work in the manner that he has done it. In connection with a pediatrician, I undertook the study of pneumonia in small children.

We studied forty-eight cases, in which the clinician suspected pneumonia or made a diagnosis of pneumonia, with the technic as I learned it from Dr. Wasson, modified for the apparatus I was using at the time.

I was able to show pneumonia; I was able to show pneumonia in cases where the pediatrician only suspected it, and in a few cases, where the examination was meant for some other purpose, showed pneumonic areas in the lungs which were proven by their development within a few days.

I think that the work that Dr. Wasson has done in postmortem injections is going to mean ever so much more to us than we can at this time appreciate. As he follows this out in future work, he will bring to us much more; knowing him as I do, I know that he will do this.

DR. R. E. LOUCKS (Detroit): I want to express my appreciation for this study of the thymus gland. . . . It should act as a stimulus to all of us to follow up a new line of research. . . . Some few years ago Dr. Heublein, of Hartford, Connecticut, presented a paper on the treatment of thymusitis, and at that time I wondered how he got so many cases of thymus to treat. I found after going down there that he had a pediatrician in his city who was a very competent clinician and had taken every precautionary measure in the treatment of his children to prove up the presence or absence of thymus. After that I tried to instill into some of our pediatricians the importance of this study, but did not succeed very well. However, in a clinical practice and in the study of thyroid gland work, we have tried to observe the thymus condition radiographically; and now, after a study of these radiographic films of the thymus in adults, we have taken the precaution to instruct the parents of the children brought to us for diagnosis about tonsillitis. You all have patients who bring their children to you to have them examined or to get your advice about having a tonsillectomy. I never give advice

to have a tonsillectomy on any child until I have had a radiograph of that child's chest and know the size of the thymus and the area it occupies. You have only to have one sad case in your history to make you cautious for the rest of your life. It is surprising the number of enlarged thy-muses one gets; nearly all these children that need to have tonsillectomies have had repeated infections, and that means enlargement of not only the adenoids but the pharyngeal and bronchial glands, and we know that the infection of these glands stimulates the thymus to a compensatory enlargement, to manufacture a certain percentage of calcium or whatnot to control the infection. I recommend you men to look up a work of Dr. Vines, of Cambridge, that came out about a year ago. It is the best thing that has been written on the thymus and parathyroid glands, to my knowledge. He explains in connection with rickets about the large number of enlarged thymuses that we see. A child with a small larynx and trachea may get an infection that produces an inflammation of the parts, which nearly closes the lumen of the respiratory tract. The infection also produces a compensatory enlargement of the thymus and thyroid glands, which, in turn, compress the trachea *from the outside*, complexing the situation. Repeated infections keep the thymus in a state of hyperplasia, so it is suggested to the roentgenologist that he take a plate of the chest of all children presented to him for his advice about tonsillectomy and adenectomy.

DR. C. J. CHALLENGER (Chicago): Does Dr. Wasson consider every thymus projecting beyond the width of the spine, pathological?

DR. L. T. LEWALD (New York): In conjunction with the statement just made by Dr. Loucks and Dr. Wasson's slides showing changes in a thymus, and the statement in regard to operations on tonsils without an examination of the size of the thymus gland, I had an experience which

shows the necessity of a little caution. A child was visiting away from home two years after it had been examined and the mother had been told that it had an enlarged thymus gland. The child developed acute mastoiditis and the attending physician was prohibited from operating until he had a consultation as to whether it would be dangerous to give the child an anesthetic. I happened to be the one to make the examination of the chest. The child fortunately had shown a regression in the thymus and I immediately advised the operation, which was successfully carried out. The child had had one X-ray treatment after an enlarged thymus had been noted, but no subsequent X-ray examination.

I was very much interested in two other cases shown by Dr. Wasson, one showing the stomach in the chest cavity and the other case in which he said there was a right-sided heart.

DR. G. E. PFAHLER (Philadelphia): I would like to ask Dr. Wasson with reference especially to the group of cases which he calls the small or slight enlargement of the thymus, which make up the great group of babies that we examine. In 1916, in connection with some studies on children together with Dr. James McKee, of Phila-

delphia, we examined all the new-born babies and all the children that came to the clinic, without regard to their symptoms, and we found this enlarged shadow in the upper mediastinum so common that it became extremely difficult to determine its nature. I made a visit to Dr. Baetjer, in Baltimore, who, as you all know, is rather skeptical about the enlarged thymus, and he assured me that many of these shadows which I thought were enlarged thymuses were not thymuses at all, but an enlargement of the glands, probably tubercular. I must confess that ever since I have been puzzled to know what is the cause of this moderate enlargement of the upper mediastinum in children, and I would like to know whether Dr. Wasson has any means of differentiating between an enlarged thymus and an enlarged upper mediastinal gland, or considers them all enlarged thymuses.

DR. J. F. HERRICK (Ottumwa, Iowa): I found, in the examination of cases along about 1913 and 1914, that one means of determining the presence of an enlarged thymus was by the backward displacement of the trachea in a transverse view, thus differentiating it from enlarged bronchial glands.

# RADIUM AND X-RAYS IN THE TREATMENT OF ROUND-CELL SARCOMA <sup>1</sup>

BASED ON A STUDY OF SIXTY-NINE CASES

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THE term "round-cell sarcoma" is used in this paper to designate a malignant tumor originating from lymphoid tissue. With the exception of one case, these tumors have been composed of small round cells and we have, therefore, called them small round-cell sarcoma. The excepted case was composed of large round cells and we designated it large round-cell sarcoma. From a clinical anatomical point of view we have divided our material into two groups. In Group I are placed all cases in which the lesion is either localized or has involvement of only the regional lymph nodes. In Group II are placed all cases in which there are diffuse multiple lesions, so-called sarcomatosis, with or without mediastinal involvement. Many of our cases at the time of admission were classified as Group I, but soon developed multiple lesions which might be looked upon as the intermediate form to which our attention is called in Ewing's book on "Neoplastic Diseases" (1). A point in question here is whether the case which we have classified as large round-cell sarcoma is not a tumor originating in the reticular cells of the lymph nodes, and probably more resistant to radiation. It is not our intention to enter into a discussion as to the histopathology of these tumors, which is so accurately described by Ewing and others, but to try to present in some form our results with this type of growth.

In our summary of cases, 42 occurred in males between the ages of 6 and 77 years, and 27 in females between the ages of 15 months and 82 years. The age incidence is depicted in Table I. The Wassermann reaction was positive in 12 cases, or 17.4 per cent. The leukocyte count varied from 4,000 to 68,000, with a predominance

of polynuclear leukocytes, with the exception of two cases, in which the lymphocytes predominated.

TABLE I  
AGE INCIDENCE IN DECADES

	1-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	Total
Group I ..	1	2	5	4	9	7	6	1	35	
Group II ..	2	1	4	2	7	8	5	4	33	
Prophylactic				1					1	
Total .....	2	2	6	8	11	17	12	10	169	

The youngest patient was 15 months old and the oldest was 82 years. The majority of cases treated occurred between the ages of 50 and 70.

TABLE II  
DEPICTING THE PRIMARY ANATOMICAL  
LOCATION OF THE LESIONS

Abdomen .....	1
Axilla .....	1
Cervix .....	1
Chest .....	1
Face .....	2
Groin .....	3
Hip .....	1
Intestine (ileocecal region).....	1
Leg .....	1
Mediastinal .....	1
Neck .....	19
Orbital and frontal regions.....	4
Orbit—2	
Orbital cavity—1	
Frontal sinus—1	
Pharynx and nasopharynx.....	19
Larynx—1	
Nasal cavity and antrum—2	
Nasopharynx—1	
Nose—1	
Post-nasal space—3	

<sup>1</sup>Read before the Radiological Society of North America, at Atlantic City, May, 1925.

Throat—1	
Tonsil—9	
Base of tongue and tonsil—1	
Parietal .....	1
Parotid .....	2
Popliteal space .....	1
Retroperitoneal .....	4
Roof of mouth.....	1
Scapular region .....	2
Skin .....	2
Thyroid .....	1

Total number of lymphosarcoma cases  
in Groups I, II, and Prophylactic...69

*Case 5681.* Admitted Sept. 17, 1918, age 42, female, married, no children. Her family history was negative. Her present illness dated back one year, at which time she began complaining of backache and a yellowish discharge. Her family physician made a diagnosis of peritonitis and referred her to Perrysburg for treatment of a tubercular peritonitis. After taking Rollier treatment for about six months she returned to Buffalo without any improvement. She entered the City Hospital and had an exploratory operation Sept. 6, 1918, at which time a large growth was found in the retroperitoneal region, a section of which was removed and proven to be lymphosarcoma. At the time of admission she was a well-nourished woman. Her skin was pigmented from sun treatments. Her physical examination was negative except for small lymph nodes palpable in the peritonsillar region. The axillary, epitrochlear and inguinal lymph nodes were not enlarged. Heart and lungs were normal. Abdomen was enlarged about the size of a six months' pregnancy (Fig. 1). The liver was easily palpable at the free border of the ribs. The spleen was apparently normal size. On percussion there was tympany anteriorly over the abdomen, and on deep palpation there was a sense of resistance which was due to the large retroperitoneal tumor. Her blood pressure was 140 over 90. At the time of admission her blood count showed 4,002,000 red cells,

6,000 leukocytes, 36 per cent polynuclears, 54 per cent small lymphocytes. Blood counts from month to month showed the leukocyte counts varying from 4,000 to 68,000, with small lymphocytes from 13 per cent to 86 per cent.

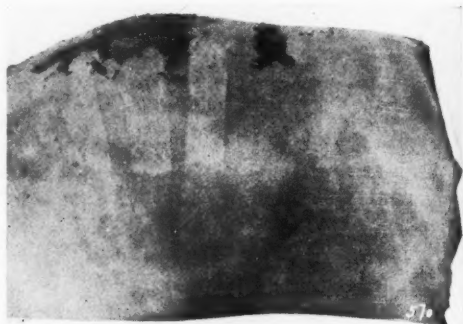


Fig. 1. Case 5681, photograph taken September 27, 1918.

The tumor had entirely disappeared so far as could be ascertained by clinical examination six weeks after admission, even before the treatment was completed. She was treated from September 23, 1918, to January 15, 1919, with X-rays, using the following factors: 5 milliamperes, 90,000 volts, 2.4 aluminum, exposure being through many ports of entry, varying from 10 to 12 minutes at 20 cm. distance.

In November, 1920, she developed an anemia, edema of the lower extremities, with enlargement of the lymph nodes in the neck and axillæ. In the upper part of the abdomen could be palpated a tumor mass which was apparently retroperitoneal. She was treated with radium packs applied over the nodes and abdomen, using the following factors: brass 2 mm., aluminum 1 mm., rubber 1 cm., 6 cm. distance, for 6,000 millicurie hours, which had a depth dose at 10 cm. of 17 per cent. Examination of the chest at that time showed increased density at the hili of both lungs, but the mediastinal shadow was not wider than normal. The liver and spleen were markedly enlarged. At that time the leukocytes reached 40,000 and there were 86 per cent small lymphocytes. On January

13, 1921, there had been complete regression of the tumor mass in the abdomen and of the nodes in the neck and axillæ. For a year following radium treatment she was well, but in February, 1922, she began having severe pain in the neck, and nervous manifestations. She was given radium packs over the region of the cervical and upper dorsal vertebræ because there was suspicion of involvement of the cervical spine, following which the anemia appeared. She became bed-ridden, complaining of pain in the neck and back which required narcotics for relief. She was unable to take food, became extremely emaciated, and died April 25, 1922. Less than two weeks previous to death, blood count showed 9,000 leukocytes with 28 per cent small lymphocytes.

This case is reported in detail in view of the fact that at the time of admission she presented a low leukocyte count with an absolute lymphocytosis, which from time to time varied in the total number of leukocytes and attained the maximum of 86 per cent lymphocytes with a tremendously large tumor mass which was primary in the retroperitoneal lymph nodes, with secondary involvement of the lymph nodes in the neck and axillæ, with progressive anemia, nervous manifestations, and termination in death. At autopsy there was no tumor tissue found anywhere. It seemed, from a careful study of this case, that this was a lymphosarcoma presenting the blood picture of an aleukemic leukemia which proved fatal after complete disappearance of all the tumor tissue.

TABLE III  
LYMPHOSARCOMA (SMALL ROUND-CELL SARCOMA), GROUP I

### 1915

Case No.	Admission Date	Diagnosis	Results
5163	July 22, 1915	Lymphosarcoma, Face	Clinically well April, 1922 (1 yr. 2 mos.). Died June, 1923, from dropsy. Patient lived 7 yrs. 11 mos. from date of admission, during which time she had seven recurrences in various places.
5190	Oct. 13, 1915	Lymphosarcoma, Tonsil	Died April, 1919, from metastases in liver. Lesion in tonsil was pronounced clinically well July 23, 1917. Palliation 3½ years.
5198	Oct. 14, 1915	Lymphosarcoma, Tonsil and Neck	Died Jan. 5, 1916, from strangulation caused by tumor. Autopsy showed lymphosarcoma of tonsil and neck with no evidence of metastases. Palliation 2 months.

### 1916

5353	Oct. 2, 1916	Lymphosarcoma, Tonsil	Died Jan. 5, 1917, probably from hemorrhage. Palliation 3 months.
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### 1917

5390	Jan. 17, 1917	Lymphosarcoma, Posterior Nares and Post-nasal Space	Died Nov. 7, 1917. Palliation 9 months.
5458	Aug. 21, 1917	Lymphosarcoma, Right Parotid	Clinically well Sept. 27, 1917. Patient has been lost track of since that date.

### 1918

5563	Apr. 17, 1918	Lymphosarcoma, Right Parotid	Died Dec. 26, 1922, from sarcomatosis, profound anemia and hemorrhage. Palliation 4 yrs. 8 mos.
5681*	Sept. 17, 1918	Lymphosarcoma, Retroperitoneal	Died April 25, 1922, from anemia. She was clinically well from Dec., 1918, until Nov., 1920, when she had a recurrence for which she was treated, and was again clinically well for a year, until Feb., 1922, when she developed anemia. Autopsy showed no evidence of tumor anywhere.

\*See further details in text.

## 1918 (continued)

<i>Case No.</i>	<i>Admission Date</i>	<i>Diagnosis</i>	<i>Results</i>
5693*	Oct. 16, 1918	Lymphosarcoma, Neck	Clinically well Nov. 13, 1918 (6 yrs. 3 mos.).
5706	Nov. 13, 1918	Lymphosarcoma, Tonsil	Clinically well Dec. 6, 1918. Patient lost track of since that date.

## 1919

5753	Jan. 27, 1919	Lymphosarcoma, Groin	Clinically well May 21, 1919. Patient lost track of since Sept., 1919.
5808*	Apr. 12, 1919	Lymphosarcoma, Neck	Died July, 1919. Palliation 2 months.
5949	Oct. 10, 1919	Lymphosarcoma, Nose	Unimproved Nov. 24, 1919. Patient failed to return.
6012	Nov. 14, 1919	Lymphosarcoma, Larynx	Unimproved April, 1920. Patient failed to return. Palliation 5 months.
6048*	Dec. 29, 1919	Lymphosarcoma, Thyroid	Clinically well March 10, 1920 (4 yrs. 11 mos.).

## 1920

6127	Mar. 24, 1920	Lymphosarcoma, Orbital Cavity	Clinically well Dec. 1, 1920 (4 yrs. 2 mos.). Intracranial involvement suspected on account of patient complaining of dizziness, but this all disappeared in Dec., 1921, following radiation.
6130	Mar. 24, 1920	Lymphosarcoma, Neck	Not treated. Patient failed to return.
6360	Sept. 20, 1920	Lymphosarcoma, Nasopharynx	Clinically well Nov. 8, 1920. Patient lost track of since Oct., 1921.

## 1921

6803	Apr. 18, 1921	Lymphosarcoma, Frontal Sinus	Died Sept., 1921 (unimproved).
7304	Dec. 14, 1921	Lymphosarcoma, Neck	Died April 29, 1922. Palliation 4 months.

## 1922

7448	Mar. 10, 1922	Lymphosarcoma, Tonsil	Clinically well May 8, 1922 (2 yrs. 9 mos.).
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## 1923

606	Jan. 20, 1923	Lymphosarcoma, Post-nasal Space	Died Aug. 19, 1923, from sarcomatosis. Palliation 7 months.
7851	Jan. 22, 1923	Lymphosarcoma, Tonsil	Not treated. Patient failed to return.
622*	Feb. 23, 1923	Lymphosarcoma, Tonsil	Died June 17, 1923, from anemia. Palliation 4 months
7917	Mar. 16, 1923	Lymphosarcoma, Neck	Died July 31, 1923. Palliation 4 months. In addition, patient had an endothelioma of the left parotid region which was apparently stationary.
7970	May 2, 1923	Lymphosarcoma, Orbit	Improved 5 months. Died Oct. 31, 1923, from heart trouble.
8100	July 30, 1923	Lymphosarcoma, Neck	Clinically well Aug. 29, 1923 (1 yr. 5 mos.).
8155	Sept. 5, 1923	Lymphosarcoma, Nasal Cavity and Antrum	Clinically well Nov. 2, 1923 (7 months). Died from typhoid fever June 3, 1924.
698	Sept. 17, 1923	Lymphosarcoma, Popliteal Space	Undetermined. She had leg amputated on account of pain Jan., 1925. Pain was due to scar from previous operation when tumor was removed, followed by radiation. Palliation 1 year.
8367	Nov. 12, 1923	Lymphosarcoma, Nasal Cavity and Antrum	Died Apr. 11, 1924. Palliation 4 months.
724	Nov. 23, 1923	Lymphosarcoma, Base of Tongue and Tonsil	Died June 30, 1924, from sarcomatosis. Original lesion in base of tongue and tonsil clinically well Jan., 1924, and remained so until death.

\*See further details in text.

## 1924

Case No.	Admission Date	Diagnosis	Results
8302	Jan. 14, 1924	Lymphosarcoma, Neck	Clinically well Sept. 12, 1924 (5 months).
8449	Apr. 16, 1924	Lymphosarcoma, Intestine, Ileocecal Region	Died May 3, 1924 (unimproved).
8689	Sept. 5, 1924	Lymphosarcoma, Parietal Region	Died Dec. 1, 1924, from sarcomatosis and anemia.
8836	Dec. 12, 1924	Lymphosarcoma, Lingual Tonsil	Clinically well Dec. 24, 1924 (1½ months).
1915—	3 cases	{ 1 clinically well 2 died	
1916—	1 “	1 died	
1917—	2 “	{ 1 died 1 clinically well	
1918—	4 “	{ 2 died 2 clinically well	
1919—	5 “	{ 2 unimproved 2 clinically well 1 died	
1920—	3 “	{ 2 clinically well 1 not treated	
1921—	2 “	2 died	
1922—	1 “	1 clinically well	
1923—	10 “	{ 2 clinically well 1 improved 1 undetermined 1 not treated 5 died	
1924—	4 “	{ 2 clinically well 2 died	
GROUP I = 35 cases			

## GROUP I

Clinically well .....13 cases (4 lost track of)

Improved ..... 1 “  
 Undetermined ..... 1 “  
 Not treated ..... 2 “  
 Unimproved ..... 2 “  
 Died .....16 “

Total number of cases in Group I...35 cases

Thirteen cases out of the 35 in Group I have been pronounced clinically well. Nine of these have been well for periods varying from 1½ months to 6 years and 3 months; the other four cases have been lost track of.

Sixteen cases died. The average length of life for these cases was 1 year and 8 months, the longest palliation being 4 years and 8 months, and the shortest 3 months.

## TABLE IV

## LYMPHOSARCOMA (SMALL ROUND-CELL SARCOMA), GROUP II

## 1914

Case No.	Admission Date	Diagnosis	Results
5005	May 8, 1914	Lymphosarcoma, Skin	Unimproved. Lost track of July, 1914.

## 1915

5185	Oct. 8, 1915	Lymphosarcoma, Eye	Died Oct. 9, 1915. Autopsy showed metastatic nodules in heart, lung, kidneys, and bladder; liver normal.
5218*	Nov. 6, 1915	Lymphosarcoma, Skin	Died Dec. 11, 1915. Autopsy showed lymphosarcomatosis.

\*See further details in text.

## 1916

<i>Case No.</i>	<i>Admission Date</i>	<i>Diagnosis</i>	<i>Results</i>
5263	Mar. 2, 1916	Lymphosarcomatosis, Probably Primary in Abdomen	Died May 3, 1916. Autopsy showed lymphosarcomatosis, especially marked in lungs.
5292	May 18, 1916	Lymphosarcomatosis, Probably Primary in Chest	Died Sept. 25, 1917. Palliation 1 yr. 4 mos.
5293	May 19, 1916	Lymphosarcoma, Tonsil and Post-nasal Space	Died June 2, 1917. Palliation 1 year. Autopsy showed metastases in duodenum, lymph nodes, testis, and adrenals.
5295	May 22, 1916	Lymphosarcomatosis, Probably Primary in Neck	Died Sept. 22, 1916. Palliation 4 months. Autopsy showed spleen to be surrounded by metastatic lymphosarcomata, also metastases in the liver, pleura, omentum, peritoneum, and lung.

## 1917

5425	May 10, 1917	Lymphosarcoma, Leg, Thigh, and Breast	Not treated. Patient did not return.
5434*	June 11, 1917	Lymphosarcoma, Face	Died Nov. 28, 1917, from progressive anemia and old age. Was clinically well Aug. 15, 1917 (palliation 3 months).
5487*	Oct. 6, 1917	Lymphosarcoma, Hip, with Spinal Metastases	Died Dec. 21, 1917. Autopsy showed metastases in kidney and spine. Palliation 2 months.

## 1918

5695	Oct. 28, 1918	Lymphosarcoma, Scapular Region	Died June 9, 1919. Palliation 8 months.
5710	Nov. 20, 1918	Lymphosarcoma, Tonsil	Died March 27, 1919. Palliation 4 months.

## 1920

6170	May 6, 1920	Lymphosarcoma, Neck and Mediastinum	Died Sept. 3, 1920. Palliation 4 months.
6201*	May 31, 1920	Lymphosarcoma, Cervix	Unimproved. Lost track of since July, 1920.

## 1921

6570	Jan. 7, 1921	Lymphosarcoma, Retroperitoneal	Died Feb., 1921 (unimproved).
7013	July 29, 1921	Lymphosarcoma, Neck, with Metastases in Liver and Retroperitoneal Region	Died Sept. 26, 1921. Palliation 2 months. Autopsy showed metastases in liver, lungs, and retroperitoneal region.
7019	Aug. 3, 1921	Lymphosarcoma, Neck	Died Nov. 4, 1921. Palliation 3 months.
7224	Nov. 7, 1921	Lymphosarcomatosis, Probably Primary in Groin	Died April 15, 1922, from sarcomatosis. Palliation 5 months.
7285	Dec. 5, 1921	Lymphosarcoma, Tonsil, Metastases in Neck	Died July 17, 1922. Palliation 7 months. Autopsy showed involvement of all the lymph nodes, infiltration of the sternum, intercostal muscles, pleura, liver, spleen, mesenteric and retroperitoneal glands and lumbar spine.
7309*	Dec. 16, 1921	Lymphosarcoma, Neck	Died Aug. 7, 1922. Palliation 8 months. The tumor had entirely disappeared on Jan. 28, 1922, but had recurred again Feb. 27, 1922. Autopsy showed metastases in spleen, both kidneys, right auricle of the heart, intestines, and lymph nodes.

## 1922

7440	Mar. 6, 1922	Lymphosarcoma, Neck and Mediastinum	Died May, 1922. Palliation 2 months.
7446	Mar. 10, 1922	Lymphosarcoma, Groin	Died Aug. 17, 1922. Palliation 5 months.

\*See further details in text.

## 1922 (continued)

Case No.	Admission Date	Diagnosis	Results
7647	Aug. 19, 1922	Lymphosarcoma, Neck and Axilla	Unimproved Oct., 1922. Family physician reported in Oct., 1922, that patient had developed marked glandular involvement, fever, prostration and general asthenia. Patient lost track of; probably died.
7683	Sept. 12, 1922	Lymphosarcomatosis, Probably Primary in Axilla	Palliation 2 yrs. 4 mos. On examination Feb. 9, 1925, there was marked induration in both groins and edema of the legs.
7693	Sept. 25, 1922	Lymphosarcomatosis, Probably Primary in Neck	Undetermined. Patient lost track of since Oct. 5, 1922.
7751	Oct. 23, 1922	Lymphosarcoma, Roof of Mouth	Undetermined. Lesion in mouth was clinically well 8 months. Patient developed sarcomatosis June, 1923, and has been lost track of since July, 1924, at which time there was only a palpable node in the axilla.

## 1923

8060*	July 6, 1923	Lymphosarcoma, Throat	Died Oct. 24, 1924. Palliation 1 yr. 3 mos.
8101	July 30, 1923	Lymphosarcomatosis, Probably Primary in Neck	Died Sept. 21, 1923. Palliation 2 months. Autopsy showed metastases in liver, spleen, kidneys, lung, thyroid, and axillary nodes.
699	Sept. 17, 1923	Lymphosarcoma, Scapular Region	Died Dec. 5, 1923 (unimproved).

## 1924

8323	Jan. 30, 1924	Lymphosarcomatosis	Died Oct. 23, 1924. Palliation 9 months. His blood count showed a high lymphocytosis.
764*	Mar. 31, 1924	Lymphosarcoma, Retroperitoneal	Palliation 10 months. On examination Feb. 2, 1925, there were no nodes palpable anywhere, but there were suspicious areas at the hili of both lungs.
8400	Mar. 17, 1924	Lymphosarcoma, Neck	Died Aug., 1924. Palliation 5 months.
8603	July 17, 1924	Lymphosarcoma, Retroperitoneal	Died Oct. 4, 1924 (unimproved).

## GROUP II

1914—	1 case	1 unimproved	Palliation .....	2 cases
1915—	2	2 died	Not treated .....	1 "
1916—	4	4 died	Undetermined .....	2 "
			Unimproved .....	3 "
			Died .....	25 "
1917—	3	{ 2 died 1 not treated	Total number of cases.....	33

Average length of life, 5 months.

(Longest palliation, 1 yr. 4 mos. Shortest palliation, 2 mos.)

## PROPHYLACTIC

1 case, clinically well since Dec. 5, 1924, one month after treatment.

1922—	6	{ 2 died 1 unimproved 2 undetermined 1 palliation	Group I .....	35 cases
1923—	3	3 died	Group II .....	33 cases
1924—	4	{ 3 died 1 palliation	Prophylactic .....	1 case
GROUP II = 33 cases			Total .....	69 cases of lymphosarcoma

\*See further details in text.

*Case 5693.* At the time of admission there was a large tumor mass in the left supraclavicular region which made pressure on the brachial plexus and vessels to the left arm, causing edema and loss of use



Fig. 2. Case 5693, showing tumor mass on November 13, 1918, before radiation, and (right) on December 11, 1918, after radiation.

of the arm (Fig. 2, before and after radiation).

*Case 5808.* This tumor presented necrotic tissue with large round cells probably springing from the reticular cells of the lymph nodes (Fig. 3). There was a primary response to radiation which was of short duration, followed by rapid growth, and death of the patient.

*Case 6048.* At the time of entrance patient had a large tumor mass occupying the thyroid region which was making pressure on the trachea and larynx, causing pronounced dyspnea. She gave a history of having been operated on by a prominent surgeon, who made a decompression operation by severing the fascia and muscles lying over the thyroid gland, which afforded some relief of pressure symptoms (Fig. 4, before and after radiation).

*Case 622.* On account of the extreme pain in the region of the gall bladder and profound jaundice, there was a question as to whether this case had a common duct stone or metastases in the liver. She had an exploratory operation March 29, 1923,



Fig. 3. Case 5808, showing tumor as it appeared April 12, 1919.

and no evidence of metastases or obstruction in the common bile duct was found. The liver was swollen, and a diagnosis of cholangitis was made. The gall bladder was drained at this time. Following the operation the jaundice cleared up, but she succumbed from progressive anemia.

*Case 5218.* This case was diagnosed as mycosis fungoides by a dermatologist. The pathological diagnosis was lymphosarcomatosis.

*Case 5434.* (See Fig. 5, before and after radiation.)

*Case 5487.* This patient had a primary lymphosarcoma of the hip which had caused extreme suffering (Fig. 6). There was response to radiation and marked general improvement, as shown in Figure 7, but the patient died later from spinal metastases and kidney involvement.

*Case 6201.* This case had a hysterectomy performed for a malignancy, which, on pathological examination, proved to be a small round-cell sarcoma. This is of interest from a pathological point of view, for this is a somewhat rare tumor to be found in this locality.

*Case 7309.* This case showed primary response after treatment with radium packs, but there was rapid recurrence, with death (Fig. 8, before radiation, and complete disappearance of tumor after radiation, and Fig. 9, showing recurrence).

*Case 8060.* The primary lesion in the pharynx and nodes in the neck disappeared following treatment, but tumor masses appeared in the mediastinum, axillæ, and groins, which, although they responded to radiation, were followed by a very diffuse sarcomatosis involving the skin of the head, neck, abdomen and thighs, profound anemia, and death.

*Case 764.* In this case there was an exploratory laparotomy performed before admission, at which time the retroperitoneal, mesenteric nodes and nodes in both groins showed lymphosarcomatosis. This case responded very well to a known dose of X-ray, which was divided over a period of twelve days as described under "Treatment."

#### TREATMENT

From 1914 to 1920 our routine treatment consisted of the use of low voltage X-rays in the earlier cases, with 5 milliamperes, 90,000 volts, 2.4 aluminum filter, at 20 cm. distance, the time factors varying from 12 to 15 minutes over the areas involved. Later the regional metastases and tumors were treated by means of radium packs filtered through 2 mm. brass, 1 mm. aluminum, 1 cm. rubber, 6 cm. distance from the skin for 6,000 millicurie hours, which gave a depth dose at 10 cm. of 17 per cent. Since 1923 some cases have been treated with a revolving radium pack (2), filtered through 2 mm. brass, 1 mm. alu-

minum,  $2\frac{1}{2}$  cm. from the skin. The erythema dose of this approximated 22,000 millicurie hours, with a depth dosage at 10 cm. of 35 per cent and at 5 cm. of approximately 75 per cent. In a few iso-

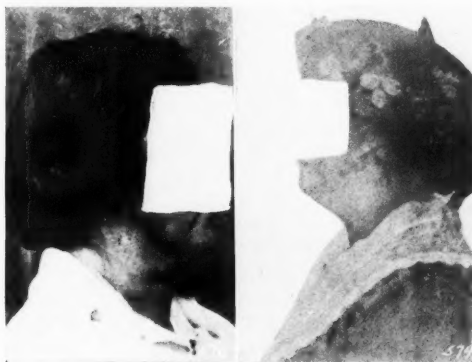


Fig. 4. Case 6048, showing tumor mass on December 19, 1919, before radiation, and (right) on March 10, 1920, after radiation.

lated cases, such as No. 724, we buried radium seeds in the primary growth in the tongue. The cases with diffuse involvement were treated by means of high voltage X-rays over the areas involved, effort being made to put 60 to 70 per cent of the skin dose into the tumor mass, conditions being 200,000 volts, copper  $\frac{1}{2}$  mm., 30 milliamperes, distance from 40 to 80 cm., depending on the depth of the lesion, and the time factor varying accordingly.

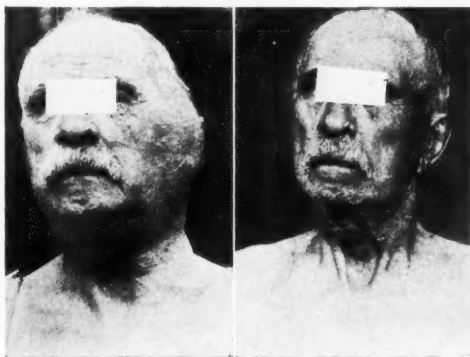


Fig. 5. Case 5434, showing tumor on June 19, 1917, before radiation, and (right) on August 15, 1917, after radiation.



Fig. 6. Case 5487, showing condition of patient on October 10, 1917, before radiation.

During the past year in cases with extensive involvement, such as No. 764 (see above), in which there was a tremendous amount of tumor occupying an extensive area (the abdomen in this case), the treatment has been divided over a period of 10 or 12 days, with several ports of entry anteriorly and posteriorly, approximating a dose of 70 per cent in the tumor masses.



Fig. 7. Case 5487, showing condition of patient twelve days later, on October 22, 1917, after radiation. Note contrast with Figure 6.



Fig. 8. Case 7309. Tumor mass on December 19, 1921, before radiation, and (right) on January 28, 1922, showing primary response to radiation.

Allowance was made for the depreciation of the dose, owing to the time interval, which amounted to 25 per cent more for each seven days during which the treatment was given. In this way we were able to cause a gradual regression of the tumor

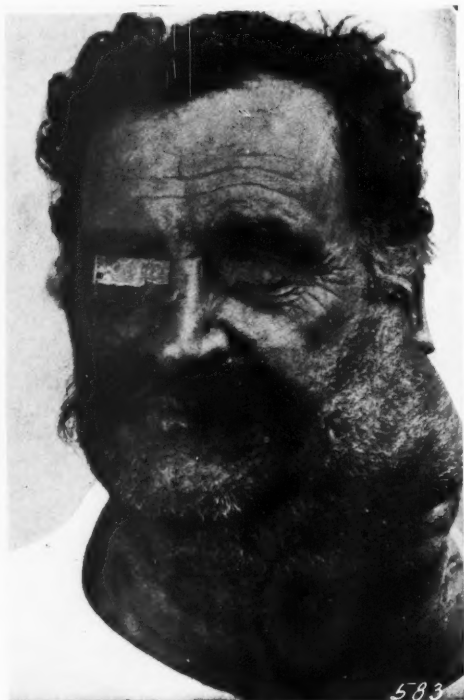


Fig. 9. Case 7309 (see Figure 8), tumor on July 20, 1922, showing recurrence after radiation.

masses in the abdomen without any severe reactions such as nausea, vomiting, great depression or anemia, keeping in mind the importance of the smallest possible body dose. In cases of lymphosarcoma, arsenic should be employed in some form, such as Fowler's solution, cacodylate of soda or atoxyl. Case No. 5434 was treated with X-rays in the usual way and after complete disappearance of the tumor, 45 c.c. of blood was removed from a vein in the arm. The serum was allowed to separate and was inactivated at 58° Centigrade. This serum was injected into case No. 5458, with negative results. When accessible, biopsy was performed as a routine, but this was not always necessary or desirable in view of the fact that 31 out of the 69 cases had been subjected to surgical interference before admission and had had microscopic examination.

#### CONCLUSIONS

I. In Group I we have obtained what apparently is a clinical healing in 13 out

of the 35 cases, which has lasted for periods varying in time up to 6 years and 3 months.

II. In Group II cases, radiation has yielded startling primary results, but recurrences in other parts of the body and anemias have proven fatal in almost all the cases.

III. In the lymphosarcomatosis cases it is far better to divide a definite amount of radiation over a period of time, from one to two weeks, in order that the body dose (3) be as small as possible.

IV. X-rays and radium together, with arsenic medication, is the method of choice in the treatment of round-cell sarcoma.

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## THE GRANULOMATA<sup>1</sup>

### HODGKIN'S DISEASE, LYMPHOSARCOMA, AND LEUKEMIA

By ALBERT SOILAND, M.D., LOS ANGELES, CALIFORNIA

**N**EARLY all authorities agree that it is practically impossible to differentiate clinically many cases of Hodgkin's disease, lymphosarcoma and leukemia. Not infrequently a simple lymphosarcoma may terminate in a generalized Hodgkin's, and, on the other hand, a primary Hodgkin's may take on the clinical appearance of malignant sarcoma. These pathological entities, with the added burden of secondary infection, will often baffle the best diagnostic ventures. The blood picture will usually distinguish leukemia from the other types. Myelogenous leukemia is ordinarily easily detected, but simple lymphatic leukemia occasionally takes on characteristics which would place it in the sarcoma group. For all of these pathological conditions, our remedial efforts have been of little avail, and even radiation offers little more in the general run of cases than temporary relief or palliation. There is, however, a ray of hope when any one of the diseases alluded to occurs in the very young; as we now have a few isolated instances where the patients have remained physically well for a varying period of years.

In this discussion, complications of specific infection, such as syphilis and tuberculosis, are not included, but those cases of persistent or enlarged thymus of the newborn may well be mentioned, as they are associated with the lymphogranulomata. In the domain of radiation therapy, there is no more striking example of efficiency than is here demonstrated. We, as radiologists, know this, but unfortunately many of the medical profession do not, as is frequently apparent. My associate, Dr. Costolow, recently attended a staff meeting in a modern hospital where the subject was under discussion because of the death of an infant by strangulation from enlarged thymus. Only one or two of the thirty or

forty doctors at the conference had heard that radiation promptly relieved such conditions. The youngest patient ever brought to our clinic was an infant girl just three hours old, from a neighborhood maternity hospital, and it was pitiful to see the little human morsel gasping for air. The little body was deeply cyanotic and when placed on its back became breathless. When held at a forward angle of about twenty-five degrees, enough air was obtainable to keep it alive. In this position, a five-minute X-ray treatment of moderate voltage was directed through the upper dorsal field and almost instantly at the commencement of the séance, the baby began to breathe. At the conclusion of the treatment, the skin color was almost normal and the child could lie and breathe in comfort on its back. Three months later the child was brought back with an X-ray plate showing a moderately enlarged thymus, but had shown no symptoms since its first treatment. A second prophylactic exposure was made at this time, and now, a year later, the child is normal. We have treated a goodly number of thymus cases but none which have made so deep an impression as the one alluded to.

One case of leukemia may be recorded briefly. A well-nourished man of fifty-four with a high leukocyte count, enlarged spleen and generalized involvement of glands was under periodic treatment for six years, remaining physically well and mentally alert. He died from an intercurrent infection.

From an experience of over twenty years in the use of radiation treatment, we have had ample opportunity to observe its effect upon the different granulomata. It is obviously impossible in clinical work to follow all the cases through and as our work up to ten years ago was not based upon the same degree of uniformity of treatment as

<sup>1</sup> Read before the Radiological Society of North America, at Atlantic City, May, 1925.

that during the past decade, this discussion is limited to a tabulation of those patients of whom we have record since 1915. We are compelled to omit mention of an approximately equal number of cases not charted, because they have not been followed or the treatment period has been too brief to be of any clinical value.

For the sake of simplicity, three charts are appended, which roughly group the cases as follows:

- Chart 1. Hodgkin's Disease,
- Chart 2. Lymphosarcoma,
- Chart 3. Lymphatic and Myelogenous Leukemia.

In many of these, a clinical diagnosis only was obtained, therefore, the accuracy of the classification is open to question.

In the records enumerated, the X-ray was the principal agent used, although this was supplemented by radium where the condition seemed suitable. A number of the patients had been subjected to the usual medicinal agents without any noticeable benefit. The radiation technic employed was that which was consistent with the standard methods in general use at the time the patients were treated, and up to four years ago the X-ray was limited to the so-called ten-inch machine, or a peak voltage of 120,000. Since then, the high voltage short waves of 220,000 volts have been employed in cases where reactions from these waves were desired.

In an earlier paper on this subject,<sup>2</sup> the radiologist was cautioned to watch the red cell count when the patient was under active radiation for fear of destruction of these cells and the lowering of the general blood tone. From more recent observations, it would seem that the red cells are not so easily disturbed. This was noted in those patients upon whom we kept a check-up on the blood during intervals between treatments.

In one specific instance where an enormous X-ray total was necessary, a distinct gain in the red cell element followed. Not only was this phenomenon noted, but the patient had an increased appetite and a



Fig. 1. Showing condition upon admittance.

gain in weight under treatment which ordinarily produces loss of weight, nausea and diminished appetite. It is interesting in this case to note that the pituitary gland was also included in the regions mapped out for treatment.

The group of lymphogranulomata enumerated is one of the most intensely interesting, as well as baffling, with which the radiologists are confronted, and while as yet we have made very little permanent progress, it must be admitted that radiation has accomplished more than any type of treatment so far attempted.

The terminus of these cases is nearly always found in the deep abdominal glands where the pathology becomes firmly entrenched and resistant to any therapeutic attack. It appears that we may successfully destroy the altered lymph nodes in every other part of the economy, even in-

<sup>2</sup> "Radiation in the Treatment of Leukemia." Read at Boston meeting, Radiological Society of North America, June 3, 1921.

cluding those of the mediastinum, but we find our Nemesis in the abdominal cavity.

Our present technic includes deep therapy up to the saturation point in every case, whether or not glandular involvement of

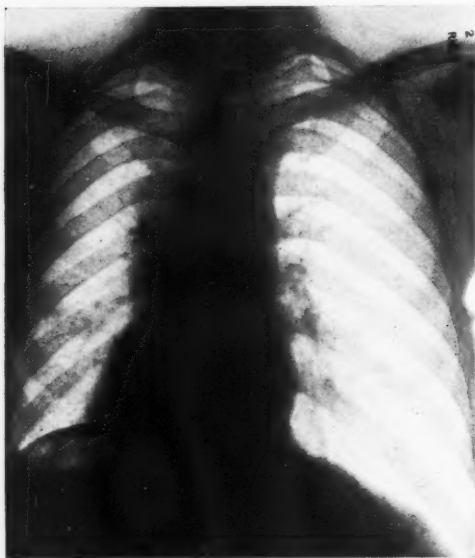


Fig. 2. Same case as Figure 1, showing condition 48 hours later.

this area can be determined. One of the tabulated cases merits special comment. This young man of athletic frame, when first seen was deeply cyanotic. The protruding thorax showed distended superficial vessels. He could not be removed from bed, was laboring for air and apparently moribund. A bedside X-ray examination revealed almost total obstruction of lung and heart spaces. In fact, the cavity of the chest seemed filled with abnormal tissue. Under deep therapy, free breathing was restored within twenty-four hours and in two weeks' time his chest was clear. This patient has had a diffuse invasion of all lymph channels, with many recrudescences. After each treatment period he has obtained relief, but is gradually becoming weaker, and, while he has survived for eight months, the outlook is not favorable.

#### HODGKIN'S DISEASE—42 CASES: SUMMARY

##### Sex—

Males—24 cases

Females—18 cases

##### Age—

Youngest—11 years

Oldest—85 years

##### Results—

Known dead—17 cases

Not traced—6 cases

Alive—19 cases

##### Life period of 17 deceased under treatment—

2 had passed 7 year period

3 had passed 6 year period

2 had passed 5 year period

1 had passed 4 year period

4 had passed 3 year period

2 had passed 2 year period

3 had passed 1 year period

##### Patients still alive—

4 have passed 8 year period

2 have passed 7 year period

3 have passed 6 year period

1 has passed 5 year period

4 have passed 4 year period

3 have passed 3 year period

1 has passed 2 year period

1 has passed 1 year period

##### Remarks—

Cases under 1 year's observation not charted.

Longest period treatment and observation, 10 years.

Microscopic diagnosis in approximately 50 per cent of cases.

No material response from radiation in 5 cases.

Temporary relief from radiation in 6 cases.

Marked relief from radiation in 31 cases.

#### LYMPHOSARCOMA—30 CASES: SUMMARY

##### Location of Lesion—

Chest—4 cases

Abdomen—6 cases

Tonsil—6 cases

Inguinal glands—3 cases

Cervical glands—8 cases

Axillary glands—3 cases

*Sex—*

Males—19 cases  
Females—11 cases

*Age—*

Youngest—11½ years  
Oldest—71 years

*Remarks—*

Cases under 1 year's observation not charted.  
Longest period of treatment and observation, 11 years.  
Microscopic diagnosis in all but 5 cases.  
No material response from radiation—6 cases.  
Complete relief from initial course—11 cases.  
Response to secondary radiation—13 cases.

*Results—*

Known dead—8 cases  
No trace—3 cases  
Alive—19 cases  
Out of 30 total, 14 remain well at present writing  
5 have passed the 5 year period  
4 have passed the 3 year period  
2 have passed the 2 year period  
3 have passed the 1 year period

LEUKEMIA, LYMPHATIC AND MYELOGENOUS  
—51 CASES: SUMMARY

*Sex—*

Males—28 cases  
Females—23 cases

*Age—*

Youngest—5 years  
Oldest—71 years

*Results—*

Known dead—22  
Not traced—7  
Alive—22

*Life period of 22 deceased under treatment—*

1 had passed 9 year period  
2 had passed 8 year period  
4 had passed 7 year period  
2 had passed 6 year period  
2 had passed 5 year period  
3 had passed 4 year period

4 had passed 3 year period  
3 had passed 2 year period  
1 had passed 1 year period

*Patients still alive—*

3 have passed 6 year period  
2 have passed 5 year period  
2 have passed 4 year period  
6 have passed 3 year period  
5 have passed 2 year period  
4 have passed 1 year period

*Remarks—*

Cases under 1 year's observation not charted.  
Longest period treatment and observation, 9 years.  
Blood examination routine procedure.  
No material response to radiation—3 cases.  
Moderate relief from radiation—14 cases.  
Marked relief from radiation—34 cases.

## DISCUSSION

DR. BURTON J. LEE (New York): There are two reactions I have had to these papers: First, that the whole subject of malignant granulomata and their relationship to malignant disease is most complex, and we have here represented a group of allied diseases. Yesterday at the Memorial Hospital a case was recited by Dr. Stone, of a man with a large tumor in the neck, presumably a lymphosarcoma. One picture was that which would readily go with lymphosarcoma and not with any type of leukemia. The case gave us the usual reaction following X-radiation to lymphosarcoma, immediate marked regression in the tumor, and we felt certain that the case was lymphosarcoma. This case was followed for a number of years and now gives a typical perfect picture of lymphatic leukemia. We have had now several cases of this type in the clinic. Dr. Ewing has pointed out on numerous occasions the relationship with Hodgkin's disease and endothelioma of lymph nodes. I think one of the most important functions the radiologist can perform to-day is to endeavor to weave

his way skillfully through this maze of pathological material, and to endeavor to place each case in the proper classification, because we have a large group of diseases with relationships and differentiations which the radiologist is particularly competent to help us to define. One other thing about treatment. Cases of Hodgkin's disease, of lymphosarcoma, which have seemed to be under-treated, have done best. It is quite striking that many of the cases of Hodgkin's disease which have had the best regression, which are known to have done best generally, are those that have been under-treated, and I think the principle which one may deduce is that perhaps it is the patient as much as the particular evident disease of which one must think. We must bear in mind that we are treating patients rather than obvious palpable diseases, because patients who die from a lymphosarcoma—one of whom Dr. Soiland mentioned—without evidence of disease, do die of the disease for which they are being treated.

DR. SCHREINER (closing): I believe, as Dr. Lee believes, that there is a mass of diseases relegated under the term of lymphogranuloma, whether they be lymphatic or myelogenous leukemia, or Hodgkin's or so-called lymphogranuloma or lymphosarcoma. There is no doubt in the past we have over-treated some of these diseases, particularly the lymphosarcoma. That is verified by the variation in the technic from time to time which is derived from closer clinical observation. It seems to me that when you speak of lymphatic leukemia and myelogenous leukemia, Hodgkin's disease and lymphosarcoma in the same breath, there is apt to be a great disturbance in one's equilibrium in trying to classify the results obtained. I believe the lymphatic leukemias are fatal, and that we can produce palliation varying up to two years in time; with myelogenous leukemias, probably an average of two and a half years; with Hodgkin's disease the average is not any longer. We have had cases which ap-

parently were clinically well, so far as the tumor masses were concerned, but they had recurrences and eventually, in the terminal stages, fever, progressive anemia, and, in the end, death. Lymphosarcoma groups particularly interest me, for the reason that we can frequently make a diagnosis by the application of radiation, so that it is not always necessary to have a biopsy. We try to eliminate leukemias by blood examination. There were two cases in the sixty-nine that I reported, which undoubtedly were the intermediate or connecting links between the leukemias and the lymphosarcoma group. Both of these cases were biopsied and gave the histological picture of lymphosarcoma. Both of them showed slight leukocytosis with absolute lymphocytosis.

Any discussion of radiation in malignant disease, or this group of lymphogranuloma, must necessarily bring up the question, How do X-rays or radium rays act? This is a field in which a great many investigators are busily engaged trying to give us some definite idea how these agents do work. Do they act by specific action on a tumor cell, or do they act on the tumor cells plus the normal cells in the immediate neighborhood? There is evidence to show that the biological effect is not confined to the tumor cells themselves, but rather, probably, a combination of the effect of radiation on the normal tissues surrounding the tumor.

DR. SOILAND (closing): Dr. Schreiner has summed up the whole matter so well that I will not attempt to add anything to his discussion. I appreciate Dr. Lee's comments on the general subject. I feel that we, as radiologists, are becoming more and more that which we are striving to be—clinicians. We are becoming clinicians, and in that capacity are able to act in a better relation with our patients. I do not quite agree with Dr. Lee in the statement I think he made, that some of the cases of Hodgkin's disease got along better without treatment.

DR. LEE: Some of the cases that showed some regression, but not complete disappearance of the nodes, had a better clinical course than those where they disappeared early.

DR. SOILAND: I understood you to say that some of the cases got along better without treatment. We do not get those cases until they are suffering from the disease and they nearly always respond to treatment, at least to a certain degree.

**Syphilis of the stomach.**—Andral reported two cases of supposed syphilis of the stomach in 1834 and from that date to the present time there has existed a controversy over many aspects of this condition. Chiari in 1891 published a comprehensive paper with a review of the literature, in which he emphasized the rarity of syphilis of the stomach as demonstrated by histological evidence. He could find only seven cases in which he was willing to accept the diagnosis. He added two of his own which he came upon at autopsy. The diagnosis of syphilis of the stomach should be made only on histological evidence. Of recent years innumerable cases have been reported without histological and often even without sound clinical evidence. The remainder of the paper is taken up with a discussion of those cases reported in the literature, with a histological basis for the diagnosis.

Flexner, in 1898, and Pappenheimer and Woodruff, in 1906, each presented one additional case; also added five more from literature. Pater, in 1906, added seven more which he accepted as histologically proven. In 1922, McNee reported the only case in which the finding of the spirochete proved beyond a doubt the syphilitic character of the disease. Graham, in 1922, reported a case. Brams and Meyer, in 1923, reported two additional acceptable cases. No other authentic cases are reported; all others

appearing in the literature must be disregarded owing to lack of histological evidence. Only twenty-five cases with histological proof are on record. From the proven cases the following characteristics are observed:

1. Syphilis produces actual changes in the stomach.

2. They may be direct or indirect.

3. The first are gummatous or simply inflammatory infiltration.

4. Gumma may occur in both hereditary and acquired syphilis; the infiltration was seen only in the former.

5. The indirect results are due to syphilitic changes in other organs, for example, the liver, or in producing the hemorrhagic diathesis, so-called hemorrhagic syphilis, and are relatively frequent.

6. Gumma always apparently first starts in the submucosa and extends from there into the other coats.

7. Through the breaking down of the gumma, particularly because of the action of the gastric juice, ulcer, and ultimately scars, may form; then only by the finding of other gummata or the remains of gummatous tissue can the syphilitic nature be established.

L. R. SANTE, M.D.

*Syphilis of the Stomach.* John A. Hartwell. *Annals of Surgery*, April, 1925, p. 767.

## THE ROENTGEN-RAY DIAGNOSIS OF RENAL TUMORS

By KEITH T. MEYER, M.D., Roentgenologist of the Walker Hospital Clinic, EVANSVILLE, INDIANA

THE early clinical recognition of renal tumors is probably one of the most difficult diagnostic problems with which the physician has to cope. In fact, prior to the advent of the cystoscope and the roentgen ray, clinical recognition of these tumors was unusual. Gurlt, in 1880, reviewing 14,630 cases of malignancy from Vienna hospitals, found only 16 clinically recognized renal tumors (1-914). The relative frequency of kidney tumors among tumors in general is 0.5 per cent (1-200) for adults; Wood has put it as high as 2 per cent. In children it is very much greater—20.4 per cent. The frequency of renal tumors in adults is 0.25 per cent (1-900), whereas in children it is much rarer—0.6 per cent (1-1600). Due to the uncertain knowledge of the pathogenesis no definite classification of kidney tumors has as yet been successfully arrived at. Many suggested classifications have, therefore, been brought forward. Of kidney tumors, the hypernephroma is much the most frequent. Hyman collected 443 kidney tumors, of which 287 were hypernephromas, *i.e.*, 65 per cent; the Mount Sinai Hospital showed 36 hypernephromas out of 38 kidney tumors, almost 95 per cent; and of 92 renal tumors occurring at the Mayo Clinic and recorded by Wilson, 68, *i.e.*, 78 per cent, were hypernephromata. Other primary lesions of the kidney parenchyma found are the adenoma, carcinoma, sarcoma, teratoma, and the various benign connective tissue type tumors. Primary neoplasms of the renal pelvis are the papilloma, papillary carcinoma, and epithelioma (squamous cell). Five cases of squamous-cell tumors of the renal pelvis have been observed at the Mayo Clinic between 1907 and 1922.

The insidious onset of renal tumors makes it particularly difficult to arrive at an early successful clinical diagnosis. In the majority of instances, it is only after the discovery of a palpable tumor mass or

a sudden severe gross hematuria, that the physician is awakened to the fact that the patient has a pathological process in the urinary tract. Even then, the importance of a gross hematuria as a symptom, in the minds of the medical public, has not been sufficiently impressed, and as a consequence there is a tendency to postpone the attempt to accurately determine the cause. In the majority of cases, the family physician will attempt to explain away the etiological factor as being due to the passage of a shower of calcium oxalate or urate crystals and may refer the patient to the roentgenologist to confirm this diagnosis of stone in the genito-urinary tract. Renal stones which may be shown in the radiograph are occasionally associated with tumors of the kidney. In Kretschmer's collected series of 43 cases of flat carcinoma of the renal pelvis, there were eleven cases associated with stones. The roentgenologist should, therefore, be associated with a competent urologist, who by cystoscopy can aid him materially in arriving at a successful diagnosis. W. E. Stevens, in reviewing 413 cases of malignant tumors of the kidney, found three confirmed symptoms of malignant tumor—hematuria, pain, and palpable tumor—present in only 44 per cent of the cases, while pyelography revealed definite evidence in almost every case.

In the study of renal tumors by means of the X-ray, it is essential that the gastrointestinal tract be as free from gas and fecal concretions as is possible. In this clinic, it is our routine procedure to have the patient given, the night before the examination, a vegetable cathartic, to be followed the following morning by two cleansing enemas. The proper giving of these enemas is a very important factor in the preparation of the patient; in fact, if these are given properly, there should be no reason why all the gas and fecal concretions should not be removed from the gastrointestinal tract. The nurse should be in-

structed to have the patient lie, first on the left side, then on the back, and finally on the right side, at the same time massaging the abdomen in the direction of the flow of the fluid. After the second enema has been expelled, the patient is removed to the radiographic room. All kidney examinations are made on 14 x 17 duplitized films with double screens and on a Potter-Bucky diaphragm. Two films are used: on one, the crest of the ilium is placed one inch above the center of the film, thus giving a complete view of the bladder and the ureters; on the other, the crest of the ilium is placed one inch below the center of the film, thus showing both kidneys and both ureters. Fairly deep compression, by means of an inflated rubber bag, is always used and the tube remains over the center of the diaphragm without tilting.

The use of the Potter-Bucky diaphragm has made it possible, in a large majority of cases, to visualize definitely the normal kidney on the radiographic plate. Failure to do so always suggests, in our minds, definite renal or perirenal pathology. This is more particularly true in individuals having undeveloped muscles, than in those having powerful abdominal muscles, which are obstacles to compression. In obese patients, a good outline of the kidney is usually obtained on account of their weak muscles, which allow the abdominal contents to be pushed aside easily and also because the highly adipose capsule of the kidney makes a contrast with the denser renal tissue. Distention of the colon constitutes one of the most simple and most harmless methods of examining the kidneys. The insufflation should be under fluoroscopic control; for in each case there is a certain amount of gas which gives the best result. This will generally determine whether a given abdominal tumor belongs to the kidney or not. We have not found it necessary to carry out the Carelli-Sordelli method of perirenal insufflation with CO<sub>2</sub> gas or insufflating the peritoneal cavity with gas in order to obtain visceral disassociation.

These radiographs, therefore, should definitely determine, in 90 per cent of the cases, the presence of renal, ureteral, and bladder stones; also, the size, position, and contour of the kidneys. After satisfactory radiographs have been obtained, the patient is then cystoscoped and a pyelogram is made of the offending kidney. The opaque solution used, a 12½ per cent solution of sodium iodide, is given by the syringe method and the patient instructed to advise when he has definite pain in the kidney area. It has been our experience in the filling of the pelvis of renal tumors, that the pain sense is markedly diminished, particularly in tumors of the parenchyma. As a consequence of over-filling the kidney pelvis, there will be regurgitation of the iodide solution into the bladder, with the patient complaining of pain in the bladder area.

In pyelograms of kidneys in which nothing definitely wrong has been found, one is impressed with the marked variation in the types of pelvis found. Eisendrath describes the most frequent type as one in which there is a well-developed kidney pelvis proper, from which arise superior, middle, and inferior major calices, and from these a variable number of minor calices. Occasionally one may see a pelvis where there is scarcely any narrowing of the pelvis at the junction with the ureter, while the major calices are so long-necked that at first glance they seem to be elongated as if by pressure or traction, a picture often seen in neoplasm of the kidney. Beeler and Mertz describe the normal kidney pelvis as dividing into a superior and inferior major calix, the minor calices opening into them. They believe that only occasionally the pelvis may divide into three major calices. They quote Papini, who states that when a median calix is present it is a minor calix, and only when, by chance, it opens into the angle between the major calices does it appear as a major calix. The marked variation, therefore, in the types of renal pelvis found, should make one extremely cautious

in the interpretation of the pathology as revealed by the pyelogram.

The radiographic and pyelographic evidence of renal tumors may simulate very closely, in some cases, those of the other nephropathies, and it will be only by a careful consideration of the cystoscopic findings, together with a careful clinical and physical examination, that a successful diagnosis can be arrived at. In a large percentage of cases, however, the radiographic and the pyelographic evidence ought to be conclusive. In considering the radiographic evidence of renal tumor, one must consider not only the increase in the size of the kidney, but also the contour and density of the kidney shadow. Tumors originating in the pelvis of the kidney would, in the majority of instances, show very little evidence radiographically of tumor, either as to increase in size or in the contour of the kidney, whereas tumors of the parenchyma would be likely to show an increase in size, together with an irregular contour. An increase in the size of the kidney, due to a tumor, will be sharply defined. An irregular contour of the kidney shadow would be highly suggestive of a renal tumor. Because of the inflammatory exudate, either perirenal or renal, it will usually be exceedingly difficult to get a satisfactory radiograph of tumefactions of the kidney due to infections. Tuberculosis of the kidney will, in at least 20 per cent of the cases, show an irregular calcific deposition throughout the kidney. Braasch considers this of great diagnostic value in determining the type of tumefaction present, particularly in those cases where it is impossible to catheterize the ureter.

The pyelographic evidence of renal tumor may be determined from the size and contour of the pelvis, from the marked variation from normal of the major calices, or from both the changes seen in the pelvis and calices. Tumors arising in the pelvis may occlude the pelvis entirely or show a definite filling defect in the contour. In addition to this, there may be a marked clubbing, dilatation, or elongation of one

or more of the calices. Scholl believes that, in the majority of cases of papillary tumors of the renal pelvis, the diagnosis can be made from the pyelograms. One must consider the possibility of a filling defect in the contour of the pelvis being due to a non-opaque stone or to an unorganized blood clot. The outline of a non-opaque stone will sometimes be revealed if a radiograph is taken after the opaque solution has been withdrawn from the pelvis. Overdistention of the pelvis with the opaque solution may result in an apparent filling defect in a normal pelvis.

Tumors originating from the parenchyma may show very little change to a marked change in the size and contour of the pelvis. The pyelographic changes are usually revealed in an elongation, clubbing, and dilatation of one or all of the major calices. The term "spider pelvis" has been applied to this type of pelvis, because of its similarity of contour to that of a spider or dragon. Braasch considers this type of pelvis as pathognomonic of renal tumor. Another type of pelvis resulting from the pressure traction exerted by the growing tumor on the calices and pelvis is the cut-off calix pelvis. This type of pelvis may be simulated by the other nephropathies, and, in order to arrive at a successful diagnosis, careful attention should be paid to other findings. These compressions, distortions, and elongations of the pelvis and calices are the most common findings in all forms of renal tumor, except those in which there is an early obstruction of the pelvic outlet with resultant hydronephrosis. In addition to these findings, particular attention should be paid to the course of the ureter, to determine whether it has been displaced, either inward or outward, as either condition would be highly suggestive of a renal tumor.

#### REPORT OF CASES

*Case No. 1.*—The patient, female, age 39, was referred for radiographic and pyelographic study for a severe colicky pain in the left hypochondrium.

*Family and past history.*—Uneventful.

*Present illness.*—Two years ago, suffered with a severe colicky pain in the left hypochondrium, which lasted for several days and which was relieved only by opiates.



Fig. 1. Case No. 1. Pyelogram.

No further trouble until four months later, when a recurrence occurred, associated with a gross hematuria. A cystoscopic examination, done at this time, revealed blood spurting from the left ureteral orifice. Renal functional tests negative. Radiographs and pyelograms revealed a filling defect in the contour of the pelvis. A diagnosis of papilloma of the pelvis of the left kidney was made at this time, and operation advised. Attacks were less severe following this one, until about six months ago, when a tumefaction was noted by the patient in the left hypochondrium. About this time she began to have a dull, heavy ache in this region that was constant and greatly aggravated by lifting. No bleeding of any kind for three months. At first was obliged to get up hourly at night to urinate; lately, is obliged to get up only once.

*Physical examination.*—Essentially negative, except for a tumor mass in the left hypochondrium. No rigidity of abdominal

muscles. Some tenderness on pressure over left abdomen. Liver and spleen not palpable.

*Cystoscopic examination.*—Revealed a normal bladder. Both ureteral orifices

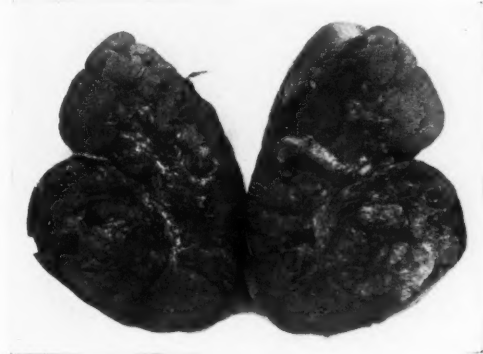


Fig. 2. Case No. 1. Kidney.

normal as to appearance and action. Blood was spouting from the left ureteral orifice. Catheters passed easily to both kidneys. Clear urine was obtained from the right kidney; left kidney, considerable microscopic blood in urine.

*Radiographic examination.*—Right kidney shows some compensatory hypertrophy, normal as to position and contour. Left kidney definitely enlarged, particularly the lower pole; normal as to position. Both kidneys negative for definite calculus.

*Pyelogram.*—Pyelogram of left kidney shows a markedly dilated pelvis, rotated upward, outward, and anteriorly. The major calices are elongated, dilated, and blunted. The minor calices are obliterated. Five c.c. of the opaque solution is completely separated from the main portion of the opaque solution.

*Operation.*—Nephrectomy, left kidney.

*Tissue examination.*—Hypernephroma.

*Case No. 2.*—The patient, female, age 31, was referred for radiographic and pyelographic examination for gross hematuria.

*Family and past history.*—Uneventful.

*Present illness.*—Began, about nine weeks ago, with patient having a severe

hematuria. This has been constant, more or less, since. No frequency of urination. No dysuria.

*Physical examination.*—Head, neck, chest, and extremities negative. Abdomen, no masses palpable. Liver, spleen, and kidneys, not palpable. No rigidity of ab-



Fig. 3. Case No. 1. Kidney.

dominal muscles and no tenderness to deep pressure. *Genito-urinary:* a profuse vaginal discharge. Meatus of urethra puffed slightly.

*Cystoscopic examination.*—Bladder was entered easily, without pain. One hundred c.c. of bloody urine withdrawn. Bladder irrigated with boric acid solution until washing returned clear. Twenty-four F. scope introduced, repeated irrigations through scope. Bladder apparently normal; trigon slightly reddened. Urine from right ureter, clear; left ureter, spurting blood.

*Radiographic examination.*—Right kidney normal as to position and contour; compensatory hypertrophy. Left kidney normal as to position; lower pole enlarged, with an irregular calcified deposition in cortex.

*Pyelogram.*—Left kidney revealed a markedly dilated pelvis, rotated upward, outward, and anteriorly. The major calices are dilated and blunted. The minor calices are obliterated.

*Operation.*—Nephrectomy, cystic left kidney removed. The kidney was enlarged,

the upper half being a continuous hollow cavity with several small cavities about it. The lower half of the kidney, thickened and fibrous, several small cavities filled with pus, and two calcified areas, size of a pea. Pelvis dilated, with walls very thin.

*Tissue examination.*—Cystic kidney.

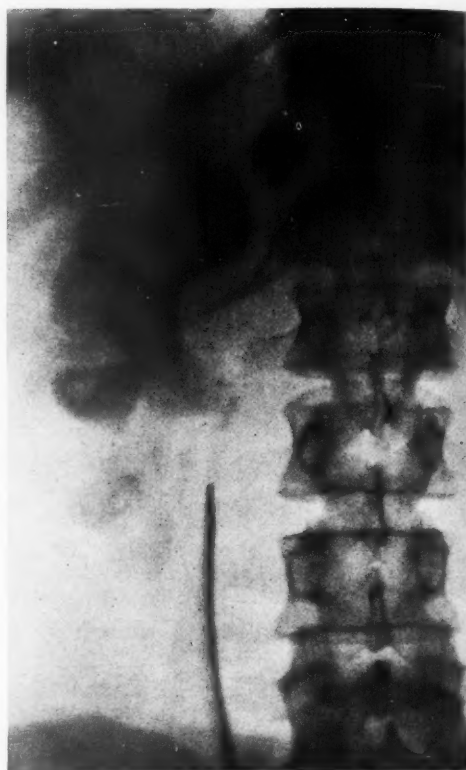


Fig. 4. Case No. 2. Pyelogram.

*Case No. 3.*—The patient, male, age 77, referred for radiographic and pyelographic examination for a gross hematuria.

*Family and past history.*—Uneventful.

*Present illness.*—Began about a year ago, with a severe hematuria lasting one day. Since then, has had two attacks. The present attack is much the most severe, the patient having been catheterized three times to draw off clots of blood. Only occasionally, since the onset of his present illness, has the patient complained of frequency of urination. There has never been any

dysuria. Only occasionally is there any pain in the right kidney region.

*Physical examination.*—Essentially negative. There is some tenderness in the right kidney region. No masses palpable and no rigidity of the abdominal muscles.



Fig. 5. Case No. 3. Pyelogram.

*Cystoscopic examination.*—Two No. 21 cystoscopes passed easily. One ounce of residual urine in bladder. Bladder capacity 300 c.c. Bladder mucous membrane normal except for trabeculations in roof and a slight inflammation in the region of the trigon. There is a slight vesical enlargement of the prostate of the collar type. Both ureteral orifices are normal as to appearance and contour. Catheterized specimen from right ureter revealed a few red blood cells; left ureter negative.

*Radiographic examination.*—Urogenital tract negative for definite calculus. Left kidney normal as to position, size, and contour. Right kidney normal as to position; a globular mass of the same density as the kidney structure, size of a lemon, can be visualized arising from the anterior surface of the lower two-thirds of the cortex.

*Pyelogram of right kidney.*—Thirty c.c. of sodium iodide was injected into the pel-



Fig. 6. Case No. 4. Pyelogram.

vis by the syringe method. The patient complained of no pain during the injection. About 15 c.c. was regurgitated into bladder. The pelvis proper was normal as to contour and size. The middle and inferior major calices were definitely elongated, with a blunting of the minor calices.

*Diagnosis.*—Renal tumor, probably malignant.

*Operation* advised; patient refused operation.

*Case No. 4.*—The patient, female, age 39, referred for radiographic and pyelographic examination for tumefaction in the left lumbar region.

*Family and past history.*—Uneventful.

*Present illness.*—Began two years ago, following the birth of her last child, with a dull ache, pressing in character, in left inguinal region. Two weeks ago, while taking a bath, noticed a swelling or lump in

the left hypochondrium. Complains of a bearing-down sensation in the left side, which begins in the left hypochondrium and runs down to the bladder area, following the course of the left ureter. Has had an



Fig. 7. Case No. 5. Pyelogram.

increase in frequency of urination. No nocturia or dysuria.

*Physical examination.*—Head, neck, and chest apparently normal. *Abdomen:* A mass can be palpated in the left hypochondrium, almost half again the size of a normal kidney, which extends downward almost to the crest of the ilium; the mass is smooth in contour. *Genito-urinary:* Bimanual examination, lacerated perineum, second degree; with the uterus slightly anterior.

*Cystoscopic examination.*—Twenty-four F. scope introduced. Bladder mucosa apparently normal. Both ureteral openings normal as to action. Catheters passed to each kidney without difficulty.

*Radiographic examination.*—*Left kidney* normal as to position; extending from lower pole is an irregular mass, size of a baseball and of the same density as the kidney contour. *Right kidney* ptosed and definitely enlarged. Both kidneys negative for definite calculus.

*Pyelogram* of left kidney shows an elongated pelvis, with a kink in the ureter, about one inch beneath entrance into pelvis. The inferior calix is elongated and dilated; the minor calices are obliterated.



Fig. 8. Case No. 6. Pyelogram.

*Operation.*—Nephrectomy, left kidney.

*Pathological report.*—Kidney, weight 224 grams; size 11 cm. x 8 cm. Tumor rounded, completely encapsulated, growing in cortex of lower pole, size 6 cm. x 5½ cm., yellowish, very soft friable tissue.

*Microscopic examination.*—Characteristic tissue of hypernephroma.

*Case No. 5.*—The patient, female, age 56, referred for radiographic and pyelographic examination for gross hematuria.

*Family and past history.*—Uneventful.

*Present illness.*—About a year ago, began to have pain in back and in bladder; this pain, during the past two months, has localized to the right lumbar region. It is exaggerated by stooping over, and on arising will often disappear. Has been bothered considerably, during the past five months, by a constant desire to urinate, followed by cramping on voiding. Has had occasional chills and fevers during the past two months. A week ago, had a severe hematuria lasting twenty-four hours, associated with right kidney colic. Since then has not noticed any blood in urine.

*Physical examination.*—Head, neck, chest, and extremities essentially negative. *Abdomen:* Liver, spleen, and kidneys not palpable; no rigidity of abdominal muscles. Some tenderness over right kidney.



Figs. 9, 10, 11, and 12. Types of pelvis in which nothing definitely wrong was found with kidney.

*Cystoscopic examination.*—Cystoscope passes very easily and without pain. Bladder mucous membrane apparently normal except about area of trigon, where it is congested, the veins being very prominent. The left ureteral orifice is slightly more red than normal; the right ureteral orifice is smaller than normal, and reddened. Catheter passes easily to the left kidney, but passes with difficulty to the right kidney, causing the patient to complain of pain. Specimen obtained clear from each kidney, with a few small flakes in the urine. Picture of the bladder is one of an old cystitis.

*Microscopic examination* of specimens from each kidney showed about the same: small amount of blood, rare pus cells, no casts.

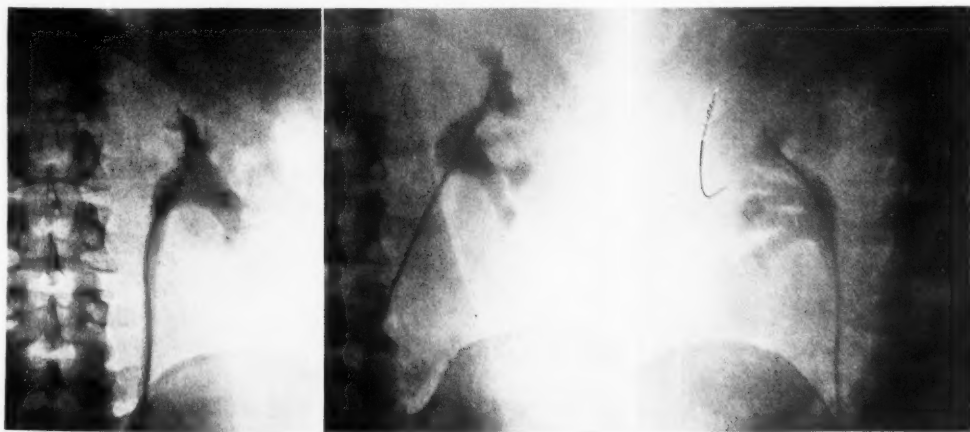
*Radiographic examination.*—Kidneys—both right and left—normal as to size, position, and contour. Genito-urinary tract negative for definite calculus.

*Pyelograms.*—Left kidney, normal pelvis and minor and major calices. *Right kidney:* Filling defect in center of pelvis, with blunting and dilatation of superior and middle major calices. Minor calices obliterated. Inferior calix not visualized. Some regurgitation of the iodide solution into bladder.

*Diagnosis.*—Papilloma of the pelvis of the right kidney.

*Operation advised:* refused.

*Case No. 6.*—The patient, female, age 24, referred for radiographic and pyelographic examination for gross hematuria.



Figs. 13, 14, and 15. Types of pelvis in which nothing definitely wrong was found with kidney.

*Family and past history.*—Negative.

*Present illness.* — About three months ago the patient was seized with a severe colicky pain in the left hypochondrium. Opiates were required to relieve the pain. Several days later, had a severe hematuria. There has been more or less of a dull ache in left hypochondrium ever since. The hematuria has occurred intermittently ever since.

*Physical examination.* — Head, neck, chest, and extremities negative. *Abdomen:* No masses palpable. Liver, spleen, and kidneys not palpable. Some tenderness on deep pressure over right kidney. No rigidity of abdominal muscles.

*Genito-urinary examination.*—Bimanual negative.

*Cystoscopic examination.* — Shows normal bladder mucosa. Left ureteral orifice normal as to action and appearance. Right ureteral orifice spouting blood. Catheters passed easily to both kidneys.

*Radiographic examination.* — Both kidneys normal as to size, position, and contour; negative for definite calculus in genito-urinary tract.

*Pyelogram.*—Pyelogram of right kidney reveals a filling defect in mid-portion of pelvic contour. Some widening and blunting of middle and inferior calices. Minor calices obliterated.

*Operation.*—Nephrectomy, right kidney.

*Pathological report.*—Papilloma of pelvis of right kidney.

#### CONCLUSIONS

1. Radiographic and pyelographic examination of the kidneys, in addition to

cystoscopy, should be made in all patients presenting any one or all of the cardinal symptoms of renal tumor—hematuria, tumor, or pain.

2. Either the radiograph or the pyelogram will, in nearly every case, present definite evidence of the presence of a renal tumor.

Acknowledgment is made of the cystoscopic assistance of Dr. Warren W. Hewins and Dr. Regel R. Acre, urologists; and for the clinical, physical, and surgical findings in Case No. 3 and Case No. 6.

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# RADIO-ACTIVE SUBSTANCES AND THEIR THERAPEUTIC USES AND APPLICATIONS

## RADIOTHERAPY OF CANCER OF THE UTERINE CERVIX

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### III. HISTOLOGICAL EFFECTS OF RADIATION

THE great prevalence of cervical cancer and the multiplicity of efforts which have been made for its relief have placed at our disposal a large amount of data as to the clinical effects produced by the various forms of treatment to which these neoplasms have been exposed. This is true of every kind of treatment which has been employed, but in the case of radiotherapy especially, because this is practically the only new form of therapy which has been possible with these lesions since the science of medicine had its inception, and consequently it has engaged the attention of scientific observers all over the world, and been submitted to a scrutiny almost unparalleled in the whole history of the art of healing.

But notwithstanding all the intensive work which has been done, when we come to investigate the effect which radiation has upon the tissues, both normal and pathologic, and to make an attempt to estimate its value and intensity as compared with other methods, it is borne in upon us that comparatively little information on this precise phase of the subject is available. As noted in a previous article (*RADIOLOGY*, Sept., 1925, p. 322), the relative malignancy of different types of cancer cell has been very exhaustively studied by Martzloff, and several investigators have used his findings as a basis for study of the effects of radiation upon these different types. The distinguished Austrian gynecologist, Oskar Frankl, has made perhaps the most complete study of the daily changes that take place in a neoplasm undergoing radiative treatment, and it is to him, and to Ewing and Schmitz in our own country, that we are still largely indebted for much of what we know regarding the

changes which take place in the tissues of the carcinomatous uterine cervix, while it is undergoing radium treatment.

Shortly before the outbreak of the European war, a number of German and Austrian gynecologists were giving a large amount of study to the application of radioactivity—both X-ray and radium therapy. The work done in Wertheim's clinic was especially noteworthy, but the war conditions soon made further investigation practically impossible, and the progress of this particular application of radiology was very seriously handicapped in all the European centers. Wertheim did, however, have opportunity to carry on systematically controlled observations of the cancerous growths before radiotherapy was applied as a preparation for radical extirpation, and, after operative removal of the uterus and its adnexa, to examine a large number of slides taken from various sections of the affected tissues, both normal and neoplastic. In this way it was possible for him to estimate how much of the cancerous lesion had been destroyed, as well as the amount of neoplastic tissue that had proved resistant to radiation and was still in a proliferative condition. In order to make this study of any value it was necessary to section the entire uterus, and the labor involved in thus scrutinizing a large number of extirpated uteri is sufficient to daunt any but the most enthusiastic investigator. Reports were made upon a series of eighteen cases, which had been under radium treatment for a period of two months, and of these, microscopic examination after surgical removal showed viable cancer tissue in sixteen. In some cases these cancer rests were very small, which led to the hope that had the treatment been continued for a longer period the entire neoplasm might have been destroyed.

The typical "Wertheim operation" had been carried out in seven of these cases. "One was a large cauliflower growth which had, under treatment, 'melted' considerably; the patient received 1,700 milligram hours within seven days. The operation, however, was rendered more difficult because of a well-marked hyperemia. The microscopic examination of the uterus showed well-retained cancer rests. One case of a very small papillary carcinomatous erosion of the anterior lip of the cervix was totally cured (5,200 milligram hours in small doses). In another case of a large circumscribed cauliflower growth of the posterior lip there were found at operation fresh multiple adhesions between the small intestine and the body of the uterus. The rectovaginal septum was infiltrated with a slimy substance; the patient died of peritonitis (20,000 milligram hours). In another case there was but slight superficial sloughing; microscopically, there were qualitative changes but no quantitative results. In still another case, there was a disappearance of the tumor, and in its place a flat area of loss of substance; microscopically, there were partly disturbed and partly retained cancer rests. The seventh case, a very large cancer of the vagina treated by 10,000 milligram hours, showed in four days a disappearance of the cancer and in its place a flat ulcer which was reduced after eleven days to half its size; microscopically, a median sagittal section showed only traces of destroyed cancer cells and the same was seen in two cross-sections through the right half of the uterus. The growth in this case had already invaded the paravaginal tissues."

Histologically, in certain of the sections examined, "the cells showed a strikingly disturbed arrangement, appearing to be loosened from their matrix. The nuclei had a decidedly marked pyknotic appearance. This was characteristic. Besides, the nuclei had a strong tendency to become confluent and to form conspicuously large numbers of giant cells. A further stage is the obliteration of the characteristic pha-

lanx-like appearance of the alveoli in the solid form of cancer; the central masses of cells are commonly destroyed first; the marginal cells retain their vitality for a much longer period. In the cases treated by large doses of radium or mesothorium, there may appear in the same section areas of necrosis, areas of hyaline degeneration, areas of large syncytium resembling masses, and of increased connective tissue proliferation. In other areas there may still be small rests of unchanged cancer cells. But characteristic for all these sections is the very conspicuous amount of round-cell infiltration. This, however, is more in evidence in the cases treated by larger doses of radium or mesothorium and those treated for a longer time. *The other anatomical structures, as, for example, blood vessels, nerves, cervix mucous glands, appear to be for the greater part, unaffected.* This, it would seem, should point to a stronger resistance possessed by these tissues on the one hand, and on the other to a possible specific or selective influence of the radium radiation on cancer cells."

The decade which has elapsed since these studies were made in the Vienna clinic has seen almost as great an upheaval in the whole theory of radiotherapy as in the political institutions of Europe. The histological findings, nevertheless, have remained constant for the same intensity of radiation and length of exposure. The necrosis and sloughing which formed so serious an obstacle to satisfactory use of radium are still in evidence and must be carefully guarded against, their elimination calling for the greatest ingenuity in filtering and the highest technical skill in planning the dosage and administering the radio-active agent. The more extended our observations become, the more it is borne in upon us that it is only by the attainment of the highest technical proficiency that we may hope to raise radiotherapy to the first rank of the instruments for combating the ravages of cancer. And before we can hope to master this technical perfection, far more minute and detailed

study of every change undergone by the tissue, both while it is actually being irradiated and after the treatment has been concluded, will have to be carried out, and constant practice and observation must tutor the hand and train the eye of him who desires to obtain the most enduring and satisfactory results.

Actuated by some such sentiments, Frankl and Amreich, in post-war Vienna, undertook a series of observations, "to determine the gradual changes brought about by radium and X-ray therapy and to standardize the technic of application." The insertion of radium into the cervical canal was regarded as more efficient and also less dangerous than its placing in the vagina. What is known as the Dominici tube—one mm. of brass covered with rubber, two to four centimeters long, and together with the filter three to five millimeters thick—was used as a filter for the radium. The end of this tube, which is allowed to project from the external os, is covered with a paraffin cylinder, three to four cm. long and concave on both ends, the whole held in place by a piece of gauze, dipped in rubber solution. The practice was to employ relatively small repeated dosage, which is diametrically opposed to that employed in the French clinics. About 50 milligrams of radium element was applied for from twelve to twenty-four hours. Four or five applications constituted a series, with a twelve to twenty-four hour interval between applications. The first series was not allowed to exceed 3,500 milligram hours. A second series was given after three or four weeks, and a third in about ten weeks. Occasionally a fourth, or even a fifth, series was given.

For the application of X-rays a symmetrical apparatus was used, raying at a focal distance of 22 centimeters and giving a maximum dose of 18 Holzknacht units, filtering through three centimeters of brass, 0.5 millimeter of zinc, wood or chamois four times as thick; 3 milliamperes, 11 Benoist, 40 minutes per field. Eight to nine fields were covered, three or four in

front, four in back, and one in the perineal region. In the first series the portio was treated, in the second the parametrium, and in each eight or nine fields were covered. Six weeks later a second series was given. Reasoning that the effect of small doses of radium is to stimulate rapid proliferation and early metastasis, and that radium is especially useful for the destruction of those malignant cells which lie nearest to the cervical canal, but that cancerous growths in the parametrium or the lymphatic glands are more likely to be destroyed by X-rays, it was thought most effectual in treating uterine carcinoma to employ X-rays and radium simultaneously. "If all the cells within the radius of the rays are given the same quantity and quality of rays, then the specific varying sensibility of the tumor element in comparison to the normal element can be brought into play without any damage to the normal cells. We know that every cell of the human body without exception is sensitive to the X-ray or radium rays, however, in varying degrees. Fortunately cancer cells, and also the specific ovarian cells, are far more sensitive than normal connective tissue cells. So it is possible by the use of certain qualities and quantities of rays, to destroy the tumor cells and follicles, without any harm whatsoever to the surrounding connective tissue."

A papillary carcinoma with small, densely packed cells of an immature type, with extensive involvement of the stroma, was selected for study of the progressive effects of radiologic treatment. Serial sections were taken at intervals from the crater and its edge. Three days after the first applications a section from the crater showed edema of the stroma and the formation of edematous lacunae. Vascularization was extensive, and there were also a number of undisturbed carcinomatous nests. No marked changes could be detected in the sections taken from the edge of the crater at this same time.

Twelve hours after the second application was made—that is, eighty-four hours

after treatment was begun—the carcinomatous cells which had been directly rayed were seen to be greatly swollen, the nuclei being much enlarged, though staining well; in the stroma edema and disintegration were in evidence, and it was prevented from adhering closely to the epithelial nests by the intervention of the edematous fluid which flowed around the alveoli. Similar changes could now be seen in the section taken from the edge, the carcinomatous cells being enlarged and areas of edema being visible.

When five days had elapsed from the time of the first treatment, and twelve hours after the third, sections taken from the most exposed areas showed enormous swelling of the pseudo-papillary tissue, with dilatation of the vessels of the elongated and thickened papillæ; scattered in the detritus were numerous epithelial cells which had become detached from the nests. The sixth day witnessed a further extension of these changes, while on the seventh day the cell nests were observed to be almost destroyed, their former extent being merely indicated by a few cells lying at the periphery. The center contained a few nucleated cells, together with the hyaline remnants of greatly enlarged cancer cells. There were areas of edema, and a general loosening of the carcinomatous cell masses had been caused by immigration of the lymphocytes. Nine days after the first treatment, and three and a half days after the fourth, those portions of the lesion which had not been so directly exposed to irradiation showed "changes which indicated a turning-point in the effect of the rays; the alveoli were broken up, the cells showed enlargement, vacuolization and hyaline changes; vacuolization had been throughout a distinct feature of the histological picture in these areas."

The tenth and eleventh days show breaking-down of the carcinomatous nests and penetration by lymphocytes throughout the whole lesion, while on the latter day the areas indirectly rayed "showed in the center of an alveolus (composed of vacuolized cells) a number of proliferating small car-

cinomatous cells, which indicated that the action of the rays was becoming less effective."

When twenty-six days had passed since the first treatment only scattered remnants of carcinomatous tissue with a very few cells surrounded by hyaline and structureless cell-aggregations could be found in the areas directly rayed. Yet forty-one days after the irradiation was first undertaken, "besides the altered tissue masses, rapidly proliferating carcinoma cells of a type resembling those present before treatment" were to be seen. Thus, "the areas directly exposed to the rays showed the first changes on the third and fourth days; the influence of the rays was greatest between the fifth and seventh days; the rays were no longer effective after the fortieth day, when the genoceptors of the cells became active and caused proliferation. Areas indirectly treated were slower in showing the changes and the effects of the treatment wore off sooner."

From his observation of the effects of irradiation upon tumor tissues Ewing postulated three main principles of radiation therapy: (1) Autolytic degeneration, observed mainly in the group of embryonal tumors; (2) Caustic destruction, employed in the treatment of resistant adult squamous carcinoma by bare radium emanation tubes, active deposit of radium and heavy doses of hard gamma and X-rays; (3) Growth restraint, illustrated in the slow regression of resistant tumors under deep radiation and in the treatment of chronic inflammatory hyperplasias. This observer found that, in general, if a tumor proved to have its origin in embryonal cells and retained in a measure the characteristics of its origin, it would prove particularly susceptible to radiation, and indeed that any rapidly proliferating cellular tumor would display this same susceptibility, "although the rapid extension of such tumors rendered the prognosis poor." But when we are called upon to deal with a neoplasm deriving from adult cells and reproducing the same type of cell, it is usual-

ly highly resistant to irradiation. Or, as it has more recently been expressed: "In theory, the least malignant cells are the least radio-sensitive, and the most malignant cells are the most radio-sensitive."

Ideal radium therapy, according to Ewing, "seems to require a nice adjustment of relations between destructive effect on tumor cells and stimulation of stroma cells. Opinions differ as to whether the action is mainly on the nucleus or on the cytoplasm, but it undoubtedly affects both, and probably in variable degree. The whole process seems to represent a peculiar form of autolytic degeneration." And he adds, "There is reason to believe that cell constituents are ionized and intracellular ferments activated so that reactions readily occur which otherwise would not occur at all." For the destruction of metastasis in the deep iliac nodes in conjunction with cancer of the uterine cervix, though profound changes are undoubtedly induced by the use of radium, this observer has never seen such metastases destroyed by radium

radiation, and he therefore advocates the Teutonic method which employs both radium and X-ray in the handling of cervical cancer by radiotherapy.

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## PROTECTION FROM AN X-RAY STANDPOINT

By E. C. JERMAN, CHICAGO

**I**N THIS article, protection is considered only from the standpoint of those who are working with the X-ray as a diagnostic agent, using energies up to 100 milliamperes and up to 140 kilovolts peak. This article does not apply to X-ray work as applied to so-called deep X-ray therapy. This is not intended as a scientific discussion, but, rather, as a practical consideration of the subject.

As an instructor in X-ray technic, the writer is placed in such a position that the information regarding protection must be given constantly, for the benefit of all concerned. He wishes it to be understood that he is expressing only his personal opinions, based upon an experience of some twenty-nine years in the operation of X-ray equipment, and a careful observation of what others, similarly situated, have been doing. This article has been prepared especially for the benefit of the lay assistant, the technician.

The maximum amount of X-radiation which any individual may receive without any ill effect would be exceedingly difficult, if not impossible, to pre-determine. Some individuals may be more—or less—susceptible than others. The extreme difficulty that enters into any exact measurement of the total energy the operator or technician may be receiving from day to day adds to the complications.

Probably one of the best general rules to observe and follow is the rule of common practice. So long as the procedure in any given laboratory corresponds to that in the great majority of other laboratories, safety from both a moral and legal standpoint is pretty well assured. This rule of common practice has had much to do with the forming of the writer's conclusions.

Protection will be considered from the standpoint of, first, the operator or technician; second, the patient, and third, the visitor. Protection of the operator or technician from X-ray energy, high tension

current and foul air, and protection of the patient and visitor from X-ray energy and high tension current will be considered.

### FIRST, THE OPERATOR OR TECHNICIAN

#### *X-ray*

Due to the fact that the technician is operating the equipment from day to day, he is subjected to a greater continuous danger than the patient or visitor.

The tube should always be operated while within the lead glass bowl provided for that purpose and never in the open.

The technician should always occupy a position to the rear of the tube or within the inactive hemisphere with the face of the anode or target from him or out of sight while tube is in operation.

The control board should be so placed, in relation to the tube, that a distance of five or six feet, as a minimum distance, will always be maintained between the technician and the tube. The greater this distance the greater the safety factor.

When using more than a five-inch gap (87 kilovolts peak) and thirty milliamperes, some kind of a protective device (a leaded glass or lead screen) should be placed between the technician and the tube while the tube is in operation. Plate glass about one-half inch thick or sheet lead about one-eighteenth inch thick are ordinarily used for this purpose. If the average number of usual exposures made daily exceeds twenty-five, if the tests (description of which follows later on in this article) indicate that the operator is in danger, or if the equipment is to be used for X-ray therapy, the control stand should be placed in an adjoining room with a double plaster wall and lead glass window between or a lead-lined booth constructed for the use of the technician. If the booth is used, it should be lined with three-sixty-fourths to one-sixteenth inch lead, top, bottom and all sides, and be provided with a lead glass

window. It would now be better to increase the minimum distance between the technician and the tube to ten feet, or more, if it be convenient.

There are two methods in common use of estimating the amount of stray or secondary X-radiation that may exist in the vicinity of the operator,—the film test and the fluoroscopic test. In using the film test method a clean, fresh dental film packet is selected. Two pieces of sheet lead one-half inch square and from one-thirty-second to one-sixteenth inch thick are cut out and one piece of lead is pasted or cemented at the center of one side of the film packet and the other piece of lead on the other side of the film packet. These two pieces of lead must be superimposed one over the other with the film packet between. Ordinary LePage's or Royal glue may be used to support the lead pieces in place. The film packet, with its lead squares in place, should then be carefully wrapped in a piece of black paper, which should assist in holding the lead squares in place. This packet is to be carried in the pocket of the operator for a period of one week continuously. The film is then developed in clean fresh solutions for the usual time, four to five minutes, and at the usual temperature, 65° to 70° F. If the film develops clear, with no image of the lead squares shown, or with only a faint shadow of the lead squares, the operator is most probably safe. If the margin of the film outside the lead square area develops out black, the operator should provide more protection for himself. The value of this test depends upon the care and accuracy with which the details are carried out. Also, one single test should not be considered sufficient. The test ought to be made from time to time, especially as the amount of energy used is increased.

The fluoroscopic test requires the use of a fluoroscopic screen, preferably the older hooded box type. This test is best made at night, when the room can be easily darkened and when the eyes of the operator are in the best condition for a test of this kind. With the room dark and the tube delivering

the energies used in routine work, the operator may quickly determine any active radiation in his vicinity by means of its action upon the fluoroscopic screen. This test, of course, should be made in the position which he would occupy while making routine exposures. If there is no illumination of the screen, the operator occupies a safe position. A faint illumination of the screen may not be important, but an intense illumination (when the bones of the hand are visible) should receive attention. The fluoroscopic test is the more sensitive of the two and may be made more quickly. If the fluoroscopic method is used, the test should also be made from time to time, especially as the amount of energy used is increased. In the manufacture of Coolidge tubes large quantities of X-ray energy are delivered during the exhausting and testing processes. The workers must be adequately protected and they rely upon the fluoroscopic test mainly. They make frequent fluoroscopic tests from their various stations and even a slight fluorescence receives prompt attention. This is especially necessary in their case, as they are continuously (during working hours) near one or more tubes in operation. The tubes are exhausted and tested within lead-enclosed rooms with heavy lead glass windows through which the performance of the tubes may be watched. The lead used in lining these rooms is about one-eighth inch thick and the lead glass windows about three-fourths inch thick. The average technician (diagnostic) has to protect himself from only a small amount of X-radiation, compared to the amount from which these workers must protect themselves.

### *High Tension*

The high tension current, used to excite the tube, is of equal importance as a dangerous agent. A very severe injury and even sudden death may result from shock received from the high tension circuit.

The overhead should be firmly fixed in position so that it can not jar loose or

fall. No dangling wires from the overhead should be permitted. The tubular overhead is safer than a wire overhead. The cord reels should be in good condition and always wind up the cords out of the way when not in use.

The milliamperemeter scale should be set from high to low or low to high, by means of a cord, as the meter is a part of the high tension circuit. The spark gap terminals or the stabilizer should not be adjusted while the tube is in operation, as both are a part of the high tension circuit. As much of the high tension circuit as possible should be placed out of reach when standing on the floor. There are two rules that every technician should observe religiously and continuously.

First, before closing an X-ray switch, always stop, look, and think. See that everybody present is in the clear, out of the danger zone of all parts of the high tension circuit. Be sure everything is correct, and then proceed. Develop the habit of doing this and your element of danger will be materially reduced. The writer has prevented a number of accidents as a result of this habit, formed during his earlier experiences. Remember that whenever you close an X-ray switch you are, in effect, firing a gun, and frequently a big one. You are responsible for the result and it is up to you to first see what is in front of the gun before you pull the trigger. Also look out for a kick-back to yourself.

Second, never leave the control board with the motor running (even though the X-ray switch is off), especially if any other individual is in sight. Better quickly develop this habit. The writer once left his control board (leaving the motor running) to readjust a patient who had moved from the desired position. Another individual, standing near, unthinkingly closed the X-ray switch. An ambulance was called for but fortunately not needed: it was two weeks, however, before the writer was able to return to his work. During the writing of this paper, the writer received information that a friend and co-worker had left

his control board (with motor running) to readjust the stabilizer. Some one standing near closed the X-ray switch. He survived the ordeal but will probably lose a part or all of one hand.

When driving a car it is not only necessary to be careful what you do yourself, but it is very essential that you watch the other fellow as well.

### *Ventilation*

A lack of proper ventilation in the operating room or dark room of an X-ray laboratory will result in a considerable degree of discomfort to the technician, if permitted to continue, and will have a tendency to lower his efficiency as well as to injure his health. Due to the ozone that is liberated in a close room where a high tension current is in operation, the air very soon becomes unfit to breathe. A free circulation of the air in the operating room obviates this danger.

The necessity of excluding all outside light from the dark room somewhat increases the difficulties of proper dark room ventilation. The technician must spend a considerable part of his time in the dark room. A drowsy sleepy technician is not a safe one and cannot do his best work under such conditions. The dark room is frequently an inside room, but some way can usually be found to provide a free circulation of air, thereby obviating this difficulty.

### SECOND, THE PATIENT

#### *X-ray Exposure*

The danger to the patient while being subjected to X-ray exposure in radiographic work is ordinarily not so great as when an X-ray treatment is given, nevertheless a real danger exists. Occasionally it is desirable to make a number of exposures in succession. Sometimes retakes may be necessary for various reasons. It is essential that the technician keep an accurate account of the total amount of

energy delivered to the patient during any one or any series of exposures.

The milliamperere-second basis for the measurement of this energy is in common use. The number of milliamperere-seconds used is found by multiplying the number of milliamperes by the number of seconds. Example: If 40 milliamperes were used for 5 seconds,  $40 \times 5$  equals 200 milliamperere-seconds. If 100 milliamperes were used for one-tenth second,  $100 \times 1/10$  equals 10 milliamperere-seconds.

The gap or voltage, the distance, and the use or non-use of a filter are important factors and must also receive consideration.

A general rule which the writer has used for several years and which has proven quite satisfactory follows: Never use to exceed 1,200 milliamperere-seconds with a focal skin distance of not less than 15 inches, with a gap ranging from 3 to 9 inches, with an aluminum filter 1 millimeter in thickness. By "focal skin distance" is meant the shortest distance between the focal spot of the tube and that part of the skin of the patient which is nearest to the focal spot. If the aluminum filter is not used, the total of 1,200 should be reduced to 800 milliamperere-seconds. The aluminum filter should always be used, as its use interferes very little with the end-result and permits of the use of about 40 per cent more energy than may safely be used without it. The filter is in general use in most up-to-date laboratories.

The above rule may be followed with every region of the body except two, the frontal sinus and mastoid. When a 15-inch distance is used, because of danger of removing the hair, the total number of milliamperere-seconds should not exceed 600. When one region of the patient has received the above limit of exposure that region should not be exposed again until after a period of thirty days has elapsed. In no case should the above limits be exceeded unless under direct orders from the radiologist in charge. While the above amount of energy seems to be well within

the limit of the danger point, that amount of energy is sufficient for any ordinary routine work unless there is something radically wrong with the technical procedure being used.

There is another rule that should be universally followed. Always ask the patient, before any exposure is made, if he has had any recent exposure, as the answer may prevent the development of an awkward situation. In one laboratory this question was not asked and the owner had to pay the sum of twenty-five hundred dollars to clear up the situation.

### *High Tension*

Because of the necessity of placing the patient quite near the high tension circuit, this danger must be given careful consideration. If the technician follows the rules given for his own protection, the danger to the patient will be materially lessened. In addition, several other rules should be followed: The patient should be carefully instructed, not in a way to frighten him, but in such a way that he will understand the importance of keeping still and away from the high tension. The greater focal film distances are to be encouraged whenever it may be convenient without a sacrifice in results. The use of the compression band is also to be encouraged whenever convenient, as it not only assists in holding the part still but helps in preventing the patient from coming in contact with the high tension current. The tube at the top of the stand is a good rule for all small children. The tube should be placed crosswise with the patient and never lengthwise. All parts of the high tension circuit should be kept at least twenty inches away from the nearest point of the patient, and a greater distance if at all convenient. All metal parts (table, tube stand, etc.) with which the patient might come in contact during the exposure should be properly grounded in order to avoid any static discharge. While this static discharge is not dangerous

within itself, it has a tendency to frighten the patient.

Do not feel that the lower energies are not so dangerous as the higher ones: one patient is known to have died as a result of contact with a circuit of approximately 45 kilovolts peak and 10 milliamperes. Any high tension circuit is dangerous. Even contact with a 110-volt circuit has been known to result in death. The patient is in your charge and you are morally and legally responsible for any accident that may occur, due to your carelessness or ignorance.

#### THIRD, THE VISITOR

Visitors (aside from assistants) should not be permitted in the operating room during exposure work unless there is a very definite reason for their presence. There is little or no danger of too much exposure to a casual visitor, especially if he is kept at a proper distance.

#### *High Tension*

The visitor must be placed in a safe place and kept there during exposure work. The visitor should never be permitted to assist in holding a patient still except in an emergency. In such emergency, extreme care must be exercised in instructing him and in keeping any part of the high tension as far away from him as possible.

#### *Fluoroscopic Work*

As a rule, all fluoroscopic examinations should be made by the radiologist in charge. It is the usual duty of the technician to prepare the patient. It is also his duty to see that the high tension circuit is at all times kept out of reach of the patient, operator, and any others who may be present. He should look after the general maintenance and operation of the equipment. The writer believes that if the above rules are carefully observed and followed, very few accidents will occur.

This article is not intended to unduly frighten those who work in this field, but, rather, to assist them, by careful, experienced advice, in assuming the responsibilities which they can not escape. While a technician must assume certain definite responsibilities, the sum total of responsibilities to be assumed is no greater than would be required in many other vocations, for instance, the driving of an automobile. Any vocation which is worth while carries its responsibilities.

In the light of experience, the writer believes that there is no longer any excuse for a serious injury to a patient from X-ray exposures in diagnostic work. If serious injury does occur, it must be due to gross ignorance or carelessness on the part of the operator.

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## CASE REPORTS AND NEW DEVICES

### A CASE REPORT OF TYPHOID PNEUMONIA

By WEBSTER W. BELDEN, M.D., Director of Department of Roentgenology, New York Hospital, NEW YORK CITY

The following case is submitted because of the interest in demonstrating an acute bronchitis, and bronchopneumonia of the left upper lobe, which we believe was caused by typhoid bacilli. No effort was made to recover the typhoid bacilli from the sputum so that the case is not definitely proven. However, the patient did go on to develop a typical attack of typhoid fever.

Osler describes typhoid pneumonia with asthenic or toxic pneumonia, stating that the local lesions may be slight in extent and the subjective phenomena of the disease absent. The nervous phenomena are usually predominating, which he mentions as delirium, prostration and early weakness. There is frequently jaundice and also diarrhea and meteorism along with abdominal pain. He says that it is difficult to differentiate between toxic or asthenic pneumonia and typhoid fever, which has set in with early localization in the lung. The differentiation can be made only by the Widal and blood cultures. In his description of the morbid anatomy of typhoid fever, he says: "One finds that 'lobar pneumonia' may be found early in the disease or it may be a late event. Hypostatic congestion and the condition of the lung spoken of as splenization occur." In describing the symptoms, he states that cough and bronchitic symptoms are not uncommon at the outset of typhoid fever. He further states that lobar pneumonia is met with at the outset, and speaks of it as the "pneumotypus of the Germans."

After an indisposition of a day or so the patient is seized with a chill, high fever and pain in his side, and within forty-eight hours there are signs of consolidation and the evidence of ordinary lobar pneumonia. Intestinal symptoms may or may not occur

until towards the end of the first week or later. Crisis does not occur, but by the end of the second week the clinical picture is that of typhoid fever. This description fits quite well with the case we have here pre-

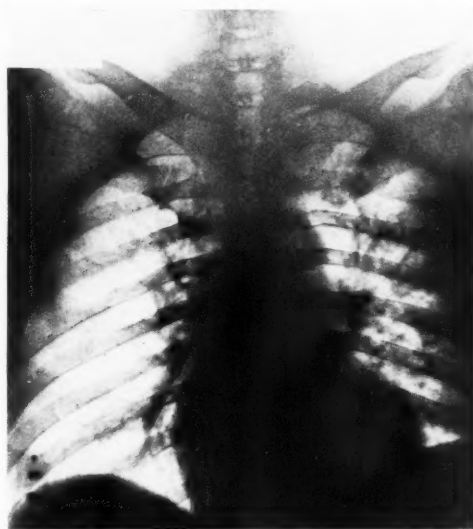


Fig. 1. Shows accentuation of hilus shadows and definite increase in linear markings in entire left lung and mottling by areas of increased density in upper lobe, especially apex.

sented. Secondly, he says that lobar pneumonia forms a serious and by no means infrequent complication of the second and third weeks.

Patient, Mr. H., was admitted December 24, 1924. He came in complaining of fever, severe headache, sensation of pressure in the epigastrium. He also had coughing and some transitory pains in his chest. Ten days before admission he had had a severe attack of cramp-like pains in the right epigastrium, lasting only half a day. They did not radiate. Just previous to his admission he had taken a heavy meal, which included a seafood cocktail. The next day he went to bed with a chilly sensation and remained there until the day of admission. He was not jaundiced; had no vomiting or diarrhea. The chilly feeling, headache, pain in the chest, and coughing

persisted. Past history is negative except for the usual childhood diseases and left lower lobar pneumonia in the Summer of 1924. Family history negative.

Physical examination revealed a well-developed Scotchman, 56 years of age,

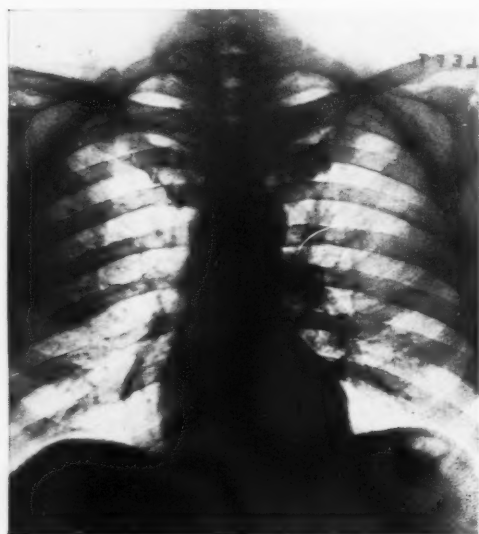


Fig. 2. Radiograph made later in which left hilus shadow is still definitely accentuated and linear markings in median portion of left lung are still increased. Mottling in upper lobe has completely disappeared.

acutely ill. The head showed nothing except a slight strabismus with an impairment of vision in the right eye. Neck was negative. Chest showed no dullness, but many fine moist râles. The heart and aorta were negative. The abdomen was distended and generally tympanic, but there was no tenderness, rigidity or rose spots. Liver and spleen not palpable. Extremities were negative except for sluggish knee jerks.

On December 26 a radiograph of his chest was made (Fig. 1), which showed a definite accentuation of the hilus shadows and a definite increase of the linear markings throughout both lungs. There was a haziness in the upper portion of the chest

over the apices on both sides, and a rather pronounced mottling by small fuzzy areas of increased density in the left upper lobe and in the left apex. The findings at this time were interpreted as being strongly suspicious of pulmonary tuberculosis, but the possibilities of typhoid bronchitis and bronchopneumonia were considered very strongly.

January 20, 1925, the thorax was again examined. At this time the hilus shadows remained accentuated and there was still a considerable increase in the linear markings. The previously noted haziness at the apices and all of the infiltration in the left lung had disappeared, so that the diagnosis of pulmonary infection other than tuberculosis was made possible.

During the period between the making of the radiographs on December 24 and January 20, the patient went on with a typical clinical case of typhoid, his temperature ranging between 104.8 and 100 for a period of three weeks, then gradually coming down to normal level. His bronchial symptoms cleared up after about a week, and during this time he had a large number of examinations of his stools, which were positive for typhoid bacilli. The blood showed a rather marked leukopenia. Blood count ranged between 4,000 and 6,000 white cells with 50 per cent polymorphonuclear leukocytes, and 35 per cent lymphocytes. Blood cultures were, at first, negative, later becoming positive for typhoid bacilli, and the Widal was positive.

The patient made an uneventful recovery and was discharged in six weeks, cured.

## A CASE OF DETECTION OF A FOREIGN BODY

By H. L. HARRIS, M.D., COLUMBUS, OHIO

The patient, a woman aged forty, supposing herself to be pregnant, inserted a catheter. Being unable to recover it, she

visited her family physician, who, employing manual methods, failed to find it. He referred the patient to a surgeon, who anesthetized her, but was likewise unable to locate the catheter the patient stated that

## A SIMPLE AND EFFECTIVE METHOD FOR MAKING POSITIVE FILM REDUCTIONS FROM X-RAY PLATES

By ALBERT R. SHELDON, M.D., Highland Park  
Hospital, HIGHLAND PARK, ILLINOIS

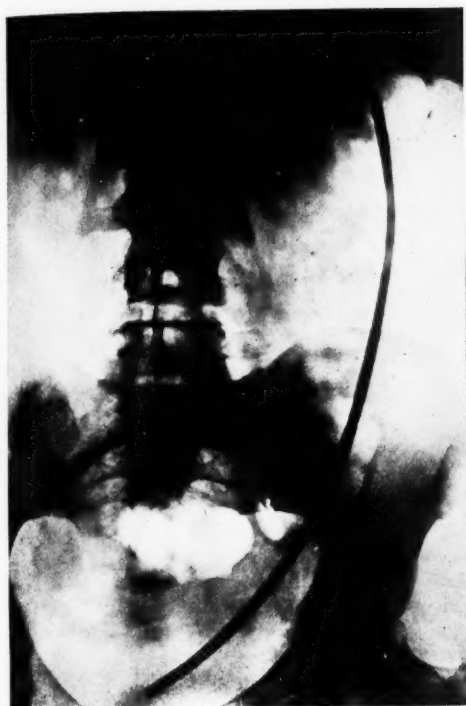


Fig. 1.

she had inserted and failed to recover. Pain developed in the region of the kidney, and the patient remained in bed for a week, her physician making a tentative diagnosis of kidney or ureteral calculus. At this time the case was referred to the writer for X-ray examination. As shown by Figure 1, no calculus but the embedded catheter was revealed as the cause of the trouble. The surgeon, upon removing it through an abdominal incision, could detect no opening through the uterus, but the omentum was wrapped around the upper end of the catheter.

The producing of X-ray contact prints is a laborious task for the roentgen department of any hospital. Photographic manipulation of the paper necessary for the larger plates, with the attendant special solutions, printing frames and trays, makes the task so burdensome that this work is usually sent to the local photographer. The resulting prints are often unsatisfactory in that much of the detail of the original is lost in the average contact print.

There are many ways in which reduced film positives may be used. Very often the patient is a transient and wishes prints to show the home physician. They are valuable for the presentation of serial plates at staff meetings and may be made a part of the roentgenologist's report to the referring physician or surgeon. Such reductions on film, when properly mounted, may be filed in a small standard size cabinet and, because of their accessibility, become increasingly valuable to the department. They are viewed in the same manner as the original and on account of their size are readily available.

With a simple and sure method of production, far greater use would be made of positive reductions on film.

There is nothing in the domain of photography more sparkling and faithful in the rendition of fine values than the positive transparency. Such reductions, made upon small cut film, entail less labor than the making of a contact print. The miniature transparency is superior to the average print in every respect.

The method we are using for the production of film reductions is not claimed to be in any way original. There are several

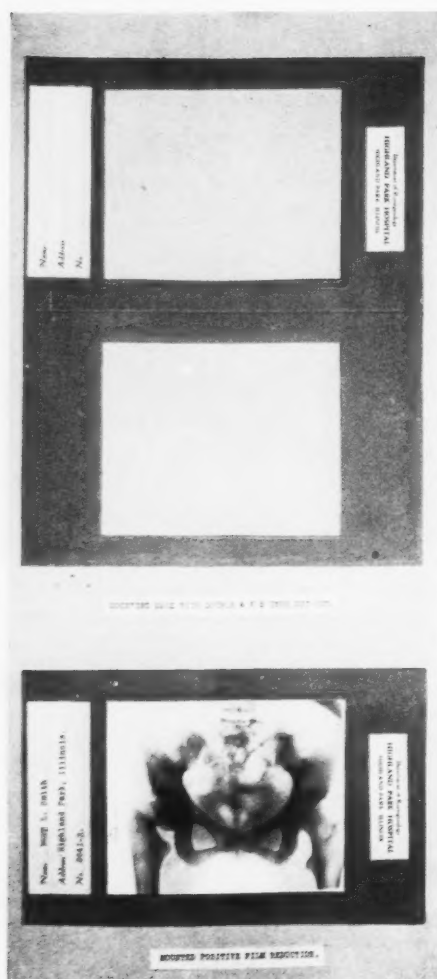


Fig. 1.

details, however, upon which we have expended considerable effort.

It has been our aim to make use of the standard photographic apparatus and solutions which are a part of the everyday equipment of the roentgen department. The process is similar to that of lantern slides up to the matter of development. The original skiagram is illuminated and the reduction made with a 5 x 7 lantern slide camera, upon which is placed a 5 x 7 back. The film upon which the reduction is to be made is placed in a cut film holder and the original reduced to 4 x 5 inches.

If special solutions had to be prepared, with tray manipulation to develop and fix the reductions, their production would be little easier than the full size contact print.

We have found that by using Eastman commercial cut film they may be placed in the ordinary frames and developed and fixed in the X-ray tank.

There was great difficulty in securing suitable cut-out masks for the effective mounting of the miniature positives. The writer is greatly indebted to Taprell, Loomis & Company, of Chicago, for producing such a mask (Fig. 1). It is of light, strong cardboard, 8 x 10 inches in size. The card, with its two 4 x 5 inch openings, makes a mount 5 x 8 inches when folded, which is the size of a standard filing cabinet. The film reduction is glued in position over one of the openings and the remaining half of the mount, with the second opening, is folded over. This makes a strong and attractive mounting with adequate space for data concerning the original.

In our own roentgen department we are finding a constantly increasing use for positive film reductions.

### AN EASEL FOR RAPID SERIALS IN GASTRO-INTESTINAL EXAMINATIONS

By E. G. C. WILLIAMS, M.D., DANVILLE, ILL.

During fluoroscopic examination, the parts of the tract which are to be radiographed serially are located with relation to the umbilicus and the patient is placed behind the easel (Fig. 1) with the desired field at the window A. Six impressions are made on each 14 x 17 film. The first three are made with the cassette resting on the hinged bar B. The last three are made on the upper half of the film by pulling out the B bar and dropping the cassette to rest on the low member of the frame at C. The entire leaded frame slides in grooves in the easel frame and clamps into position with a wing nut at D. A scale on the easel

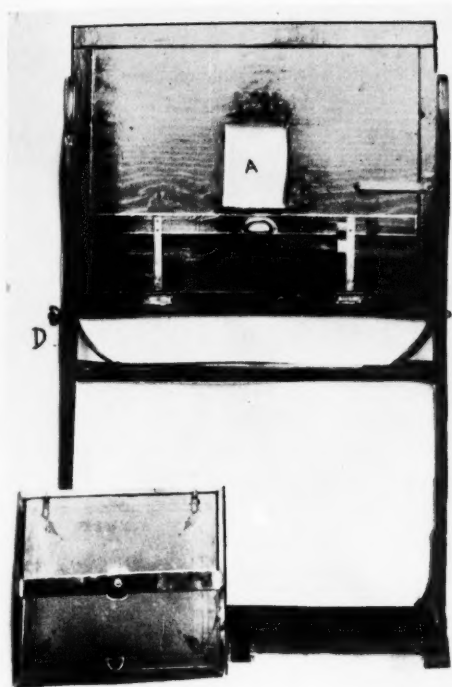


Fig. 1.

corresponds with the numbers on the tube stand, to permit rapid adjustments. Brass tacks in the floor mark the position for the easel while in use. The simplicity of the process permits speed of operation. We have made thirty-six exposures in less than one minute, almost a moving picture.

### X-RAY CONSULTATIONS OF THE FUTURE

GUY BARTLETT, General Electric Co.,  
SCHENECTADY, N. Y.

**A** TORNADO sweeps across the land, devastating the country, killing many people and injuring hundreds more. One woman receives a severe fracture of the knee, and the medical men available are unable to treat her.

An X-ray film is made of the injury, sent by wire immediately to specialists in a distant city, and within an hour an an-



Fig. 1. Photograph of original X-ray negative of hand, with ring on finger. (Courtesy of General Electric Company.)

swer is received by telegraph, with instructions for procedure, so that permanent lameness or other complications may not result.

Such is the future of medical consultations, as indicated by a recent experiment whereby an X-ray photograph was sent over telephone wires from New York to Chicago in seven minutes. Details were not lost in the procedure, and an accurate analysis of the film was possible. More than that, the picture as received in Chicago was immediately sent to New York by airplane mail and was published on the following morning by one of the newspapers there.

The case of the tornado, referred to above, is not entirely hypothetical. A woman received such an injury during the tornado that recently visited the Middle West, and it was necessary to take her to a large city for treatment. There is now

approaching, however, the possibility of bringing the specialist to the small community by means of radio and wire transmission of pictures.

In speaking of the transmission of the first radiograph, W. S. Kendrick said:



Fig. 2. Photograph of positive printed from untouched negative as received by wire in Chicago from New York. (Courtesy of General Electric Company.)

"The time element in the diagnosis of an injury or ailment by a specialist is most important. In complicated fractures or other bone injuries, a quick diagnosis is invariably desirable in order to prevent infection or other complications. A saving of hours or days means everything to the patient.

"Dr. W. D. Coolidge has perfected a portable X-ray equipment which a doctor can use anywhere by connecting it with the household lighting circuit. These widely used outfits have eliminated the necessity of moving a patient to a hospital for X-ray examination, and now telephonic transmission of photographs indicates that soon it will not be necessary to take patients to large cities in order that the services of specialists be available."

Dr. J. M. Steiner, Radiologist to the Roosevelt Hospital of New York, has pointed out the possibilities of radiographic transmission as follows: "Medical consultation between doctors on X-ray plates transmitted by radio or telegraph is a realization that should find a most useful place in these progressive times. The quick transmission obtained by this method should afford untold satisfaction to both the consultant doctor and the anxious family. We frequently have patients who are either injured or taken ill while travelling. These patients, being in strange hands, naturally desire their home physician in consultation. If explicit information could be quickly transmitted to the home physician, much needless travel could be avoided, saving the home physician or family a long trip.

"Many times physicians in small communities, desiring an opinion from a distant consultant, could materially shorten a tedious delay if X-ray plates were quickly transmitted by telegraph to these consultants, who, in turn, could render an opinion within an hour or two, where, otherwise, several days to a week or more might be involved. Written descriptions or word pictures, of such simple conditions even as fractures, are often most misleading, whereas the actual conditions shown graphically in X-ray plates are more convincing."

# EDITORIAL

M. J. HUBENY, M.D. . . . . Editor  
BENJAMIN H. ORNDOFF, M.D. } . Associate Editors  
JOHN D. CAMP, M.D. }

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## THE INJURIOUS EFFECT OF IRRADIATION

That the X-rays may seriously alter the action of living cells, even to such an extent as to induce a stubborn and intractable form of carcinoma, has long been recognized. The hundred and forty or more victims among the radiographers of the world bear mute and incontrovertible testimony to this fact. There is, however, another phase, more subtle and menacing, to the deleterious action of irradiation, which has been attracting the attention of radiographers and physicians generally in recent years. This is the obscure action of the rays in arresting normal embryonic growth or in inducing a perverted cell-growth which will result in the production of congenital physical or mental defects of varying grades of severity following irradiation of the pregnant woman. That such a possibility existed has been strenuously denied by many workers in the rays. It is only after the publication of what appear to be authentic reports of such deplorable results by trustworthy authorities of this and other countries that it has become obligatory to concede the possibility.

To Bailey and Bagg, of the United States, and Schmitt, of Germany, must be given the credit of emphasizing the danger, even in the face of active opposition by incredulous observers. These men have collated all the reports of cases of congenital injury after irradiation during pregnancy. These vary from embryonic death

with abortion to monstrous development and different grades of post-natal retardation of physical growth, with or without mental deterioration. While these cases have been numerous enough to merit recognition, the relative proportion of developmental retardation to normal growth of the offspring is very small, although not negligible. There is certainly no reason for an hysterical outcry against the use of the rays in pregnancy whenever they are urgently indicated. It becomes, under these circumstances, the choice of the lesser of two evils—whether the existing dangerous condition shall be allowed to continue untreated, or the offspring be subjected to the remote possibility of permanent injury to its developing cells, a problematic accident at the best.

It seems to us that a distinction must be drawn between the dosages of the rays as required for diagnostic and therapeutic purposes. The comparatively trifling exposure of a few seconds that is required for the making of a diagnostic plate will probably be attended by no serious consequences. The thousands of pregnant women who have been irradiated at various stages of gestation for this purpose without untoward consequences to themselves or their offspring provide ample proof of the apparent harmlessness of the process. Even here, however, it is too early as yet to determine whether a remote developmental retardation will be manifested in these children. Time alone, with careful, painstaking, scientific investigation of the children, with proper check observations, can settle this question.

There can be no doubt, on the other hand, that the prolonged exposure of a pregnant woman to the action of the X-rays when used for therapeutic purposes is very prone to result disastrously upon the growing embryo and upon the woman herself.

She may be permanently sterilized by the rays, while the embryo may show more or less marked physical and mental changes amounting at times to monstrous formation or idiocy or both. An additional possibility that has been suggested quite recently is that these malformed offspring may transmit the deformity to succeeding generations, producing in this way a variety of hereditary X-ray deformity. While the clinical reports of these unfortunate results of X-irradiation are not numerous as yet, the possibility of their occurrence must be borne in mind. We would insist, however, that a calm and rational view of the matter be taken, and that it be strongly emphasized that the danger is not an imminent one and not a cause for an unwarranted outcry against the employment of a very valuable diagnostic agent.

W. A. NEWMAN DORLAND, M.D.

PRELIMINARY PROGRAM OF ELEVENTH ANNUAL MEETING, RADIOLOGICAL SOCIETY OF NORTH AMERICA, CLEVELAND, OHIO, DECEMBER 7-11, 1925

SYMPOSIA

*Symposium on Lymphoblastoma*

Leader, A. U. DESJARDINS, M.D.

Duration of Malignant Lymphoma and the Early Abdominal Symptoms. GEORGE MINOT, M.D., Boston

Title to be announced. W. S. STONE, M.D., New York

Radiotherapy in Lymphoblastoma. ARTHUR U. DESJARDINS, M.D., Rochester, Minn.

*Symposium on Bone Tumors*

Leader, ALBERT SOILAND, M.D.

The Pathology of Bone Tumor. D. B. PHEMISTER, M.D., Chicago

A Roentgenological Study of Bone Tumor. HOWARD E. RUGGLES, M.D., and LLOYD BRYAN, M.D., San Francisco

The Surgical Aspect of Bone Tumor. H. W. MEYERDING, M.D., Rochester, Minn.

Radiation in the Treatment of Bone Tumor. ALBERT SOILAND, M.D., Los Angeles

*Symposium on Children*

Leader, W. W. WASSON, M.D.

An X-ray Study of the Development of the Ossification Centers of the Skeletal System. BUNDY ALLEN, M.D., Iowa City, Ia.

Cyclic Vomiting in Children. LEON T. LEWALD, M.D., New York

The Influence of Infection upon Development of the Accessory Nasal Sinuses. T. E. CARMODY, M.D., Denver

X-ray Diagnosis of Pulmonary Tuberculosis in Children. JOHN D. MACRAE, M.D., Asheville, N. C.

*Symposium on Chest Diagnosis*

Leader, W. I. LEFEVRE, M.D.

A Demonstration of the Main Points in the Technic of Chest Radiography. W. W. WASSON, M.D., Denver

Pulmonary Fibrosis. C. R. ORR, M.D., Buffalo

The Use of Iodized Oil in the X-ray Diagnosis of Lung Cavities. JACQUES FORESTIER, M.D., Aix - les - Bains, France

The Thymus in the Newborn and Early Infancy, with Special Reference to its Topographic Changes. G. J. NOBACK, M.D., New York

*Symposium on Kidney Diagnosis*

Leader, C. D. ENFIELD, M.D.

The Interpretation of the Pyelographic Shadow. B. H. NICHOLS, M.D., Cleveland

Variations in the Normal Ureterogram. D. N. EISENDRATH, M.D., and R. A. ARENS, M.D., Chicago.

Differential Diagnosis of Urographic Shadows from the Urologist's Standpoint. OWSLEY GRANT, M.D., Louisville

*Symposium on Gall-bladder Diagnosis*

Leader, SHERWOOD MOORE, M.D.

Title to be announced. ARIAL W. GEORGE, M.D., Boston

Gall-bladder Diagnosis from the Standpoint of the Surgeon. EVARTS A. GRAHAM, M.D., St. Louis

The Diagnosis of Gall-bladder Disease from the Medical Standpoint. B. B. VINCENT LYON, M.D., St. Louis

A Clinical Study of Cholecystitis with Cholecystography. OSCAR C. ZINK, M.D., St. Louis

*Symposium on Toxic Goiter*

Leader, B. H. NICHOLS, M.D.

Surgical Treatment of Goiter. GEORGE W. CRILE, M.D., Cleveland

Indications for Surgical Treatment of Goiter. FRANK H. LAHEY, M.D., Boston

X-ray Treatment of Goiter. HENRY KENNON DUNHAM, M.D., Cincinnati

X-ray Treatment of Goiter. E. L. JENKINSON, M.D., Chicago

The Heart and the Value of Basal Metabolism Estimations in their Relation to Diagnosis, Prognosis and Cure. BURTON E. HAMILTON, M.D., Boston

The Effect of Radiation upon the Histological Structures of the Thyroid Gland. ALLAN GRAHAM, M.D., Cleveland

*Symposium on Non-malignant Pelvic Conditions*

Leader, B. H. ORNDOFF, M.D.

Essayists and titles of papers to be announced later.

## ORIGINAL CONTRIBUTIONS

Chronic Mastitis, A New Treatment, with a Report of 150 Cases. FRANK E. ADAIR, M.D., New York

A Study of the Knee Joint, (1) Anatomical, (2) Pathological, (3) Radiological Considerations. M. A. BERNSTEIN, M.D., Chicago.

Carcinoma of the Cervix and Fundus Uteri Treated by a Combination of Surgery, Radium and X-ray. HARRY H. BOWING, M.D., Rochester, Minn.

The Effect of X-ray on the Vitamin Needs of the Organism and Cancer. MONTROSE T. BURROWS, M.D., LOUIS H. JORSTAD, M.D., and EDWIN C. ERNST, M.D., St. Louis

X-ray Findings in Lobar Pneumonia. WEBSTER W. BELDEN, M.D., New York

The Clinical and Radiological Diagnosis of Cancer of the Stomach. GEORGE B. EUSTERMAN, M.D., and R. D. CARMAN, M.D., Rochester, Minn.

Fractures of the Os Calcis. H. R. CONN, M.D., Akron, O.

Roentgen-ray Examination of the Joints of Hemophiliacs. HOWARD P. DOUB, M.D., and E. C. DAVIDSON, M.D., Detroit.

Report of the Committee on Standardization of X-ray Measurements. E. C. ERNST, M.D., *Chairman*, St. Louis

Radiological Exploration with Lipiodol. JACQUES FORESTIER, M.D., Aix-les-Bains, France

The Relation of the Roentgenologist and his Work to the Surgeon. LOUIS FRANK, M.D., Louisville

Erythema Doses in Absolute Units. OTTO GLASSER, Ph.D., New York

Diagnosis and Treatment of Bone Tumors. RALPH E. HERENDEN, M.D., New York

Roentgen Therapy in Hypofunction of the Ovary. I. SETH HIRSCH, M.D., New York

Some Important Considerations in Planning an X-ray Department. PRESTON M. HICKEY, M.D., Ann Arbor, Mich.

The Clinical Aspects of the Treatment of Diphtheria Carriers by Roentgen Rays. ETHEL D. HUMPHRYS, M.D., Denver

Leukemia. E. L. JENKINSON, M.D., Chicago

Title to be announced. B. R. KIRKLIN, M.D., Muncie, Ind.

A Report of the Treatment of Carcinoma of the Breast with Radium Emanation in Platinum Filter Needles. BURTON J. LEE, M.D., New York.

Cholecystography by the Oral Method. LESTER LEVYN, M.D., and A. H. AARON, M.D., Buffalo

Family Diverticulosis of the Colon. F. W. MACKOY, M.D., Milwaukee

Protection Standards against X-ray Dangers. A. MUTSCHELLER, Ph.D., Long Island City, N. Y.

The Necessary Liaison between Radiologist and Cardiographer. LEO E. PARISEAU, M.D., Montreal

Skin-microscopical Studies of the Roentgen-erythema. ERNST A. POHLE, M.D., Ann Arbor, Mich.

Implantation of Radium Emanation in Gold Capillary Tubes. DOUGLAS QUICK, M.D., New York

A Comparison of Radium, Long Wave and Short Wave X-rays in the Treatment of Carcinoma of the Uterine Cervix. HENRY SCHMITZ, M.D., Chicago

The Dead Fetus *in Utero*: A Clinical-radiological Study. IRVING F. STEIN, M.D., and ROBERT A. ARENS, M.D., Chicago

Radiological Study of Osteitis. C. G. SUTHERLAND, M.B., Rochester, Minn.

Diverticulum of the Stomach. HAROLD SWANBERG, M.D., Quincy, Ill.

The Bio-physical Effects from the Treatment of Diphtheria Carriers by Roentgen Rays. SANFORD WITHERS, M.D., Denver

The Relative Value of Various Technics in the Radiation Treatment of Carcinoma of the Breast as reflected in the Statistical Analysis of 707 Private Cases. G. E. PFAHLER, M.D., and B. P. WIDMANN, M.D., Philadelphia.

Prediction of the Normal Transverse Cardiac Diameter in Man. FRED J. HODGES, M.D., Madison.



The Hotel Cleveland, the headquarters. The Scientific Sessions are to be held on the mezzanine floor, and the exhibits housed nearby in this luxurious, new hotel.

The Heat Energy of X-Rays. ROY KEGERREIS, A.M., Ann Arbor.

#### MOTION PICTURE FILMS

Scientific Film "Roentgen Rays." DR. FRIEDRICH VOLTZ, Munich  
(To be shown by Dr. OTTO GLASSER)

X-ray Motion Pictures of the Thorax. HOWARD E. RUGGLES, M.D., San Francisco

Gastric Ulcers. LEWIS GREGORY COLE, M.D., New York.

#### THE CLEVELAND CONVENTION

MONDAY, DEC. 7—FRIDAY, DEC. 11

When the members of the Radiological Society of North America and their friends gather in Cleveland for the Annual Meeting they will find the stage set for what promises to be a most interesting and socially successful gathering. The Program Committee has been planning and working for months to provide a group of valuable papers, presented by able men. The Local



General view of the downtown section of Cleveland, the city chosen for the Annual Meeting, December 7-11.

Committee is carrying out its campaign promises—it numbers men who are quite capable of making the members glad they chose Cleveland as the meeting place. The Exhibitors are planning to outdo all their former efforts—the old, familiar friends will be there with all that is new in apparatus and equipment.

Cleveland's geographical location ought to satisfy both the Easterners and the Westerners, the Southerners and our Canadian friends. It is, in fact, only a few hours from everywhere. This is only one of the reasons, however, for the city's high reputation as a meeting place for societies. Cleveland hotel managers are far-sighted enough to have adhered rigidly to the policy of not increasing rates, irrespective of heavy demands for rooms. From the standpoint of recreation, the city has much to offer—exceptionally fine and numerous theaters, automobile roads radiating to country clubs, a delightful shopping district, and the best of restaurants.

The Scientific Sessions are to be held and the exhibits housed under the spacious and luxurious roof of the Hotel Cleveland,

situated on the Public Square. There the banquet will be held, also. Under that same roof, too, most of the members will choose to take rooms, and for those wise ones late hours will be robbed of their terrors, for, when they leave the gatherings, they will be within two minutes of "home."

As at former meetings, it pays to be at headquarters. This hotel has accommodations for from 1,800 to 2,000 guests, is the newest of the city's large hotels, has richly furnished lounging rooms, two large dining rooms, and a moderate-priced lunch room. There is floor clerk and servitor service. The rates are as follows:

*Single*—\$3.00, \$3.50, \$4.00, \$4.50, \$5.00, \$6.00, \$7.00, \$8.00.

*Double*—\$5.00, \$5.50, \$6.00, \$6.50, \$7.00, \$8.00, \$9.00, \$10.00.

*Twin bed*—\$7.00, \$8.00, \$9.00, \$10.00, \$12.00.

*Parlor, bedroom, and bath*, \$12.00 up, for one person.

*Parlor, bedroom, and bath*, \$14.00 up, for two persons.

*Parlor, two bedrooms, and baths, \$20.00 up, for three persons.*

*Parlor, two bedrooms and baths, \$22.00 up, for four persons.*

Those who have not already made reservations may do so—the earlier the better, for hotels, like private homes, “prepare for company.” If any reader has not yet filled out and mailed the card furnished by the hotel to members, he has only to write his requirements (single, double, twin bed, or



The Lounge in the Hotel Cleveland.

suite, stating the price, the number of persons in his party, and date of arrival) to the hotel. Mr. F. L. Bonneville is Assistant Manager and he is personally taking care of the accommodations for the meeting and the comfort of our members.

#### THE CLEVELAND MEETING

##### SPECIAL ROUND TRIP RATES GRANTED

The usual one and one-half fare on the certificate plan, for the round trip from all over the U. S. and Canada, will be effective during the Eleventh Annual Meeting of the

Radiological Society in Cleveland, December 7 to 11, 1925, inclusive. The rate is dependent upon there being 250 certificates presented for validation, as usual.

Every person attending this meeting or accompanying those attending it, should secure a CERTIFICATE when buying the ticket to Cleveland. These certificates should be deposited with the railroad clerk at the registration desk of the meeting in Hotel Cleveland, immediately upon arrival. After these certificates have been signed by the railroad clerk for the Society and validated by the agent for the railroad companies, the certificates should be called for by their owners. Announcements will be made from time to time during the meeting, relative to this. These certificates are then good for one-half fare returning over the same route to the place where the ticket was bought. Ask your local railroad agent for further particulars.

I. S. TROSTLER, M.D.,  
812 Marshall Field Annex, Chicago,  
Manager of Exhibits and Transportation.

#### THE SCIENTIFIC EXHIBIT

The local Committee on Scientific Exhibits invites and earnestly requests all members of the Radiological Society of North America to prepare film exhibits of interest for the Annual Meeting of the Society, at Cleveland, December 7-11. It is hoped that a diversified collection from a large number of individuals will be presented. Every member has some rare or unusual case worth showing to his fellows. Hospitals, sanatoriums, clinics, groups, or institutions are also invited to participate in this exhibit. Scientific exhibits allied to Radiology will also be welcome.

Original films, prints, or reductions may be used. The Committee would like to know as soon as possible the kind and amount of material to be submitted. Communications should be addressed to W. I. LeFevre, M.D., 456 Rose Building, Cleveland, Ohio, *Chairman*.

## SECTION OF RADIOLOGY OF THE STATE MEDICAL SOCIETY OF WISCONSIN

The second meeting of the Radiological Section of the State Medical Society of Wisconsin was held at a dinner-meeting, Sept. 18, 1925, Dr. M. J. Sandborn, of Appleton, presiding. The following representatives of the Radiological Society of North America were present: Dr. I. S. Trostler, Dr. H. E. Potter, Dr. B. H. Orndoff, Dr. M. J. Hubeny, of Chicago, and Dr. Alden Williams, of Grand Rapids, Mich.

After a brief résumé by the Secretary, Dr. C. W. Geyer, of the proceedings of the Society for the past year, a constitution and by-laws were adopted as read.

The following officers were elected unanimously for the coming year: Dr. M. J. Sandborn, Appleton, President; Dr. Gentz Perry, Kenosha, Vice President; Dr. C. W. Geyer, Milwaukee, Secretary and Treasurer; Dr. R. C. Bardeen, Madison, Dr. Howard Curl, Sheboygan, Dr. Joseph McMahon, Milwaukee, are members of the Executive Committee.

One year ago, at Green Bay, the State Medical Society of Wisconsin saw fit to grant a section to the roentgenologists of the State and this is the second meeting of this section. At the first meeting, held during the Tri-State Convention in Milwaukee in October, 1924, a tentative organization

was perfected and in April a meeting of the State radiologists was held at the State University at Madison, the program being arranged by Dr. R. C. Bardeen, dean of the State University Medical School.

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### JOSEPH S. MOULTON

#### IN MEMORIAM

Joseph S. Moulton was born in New Orleans, Louisiana, May 24, 1892. He received his medical education at Tulane University, being graduated in 1913.

Hospital services: Externe, Charity Hospital, New Orleans, Louisiana; Interne, St. Louis Southwestern Hospital, Texarkana, Arkansas. Assistant physician, Central Indiana Hospital, Indianapolis, Indiana. House Surgeon, Missouri Pacific Hospital, St. Louis, Missouri. Chief Resident Physician, Louisville City Hospital, Louisville, Kentucky. Chief House Surgeon, St. Louis Southwestern Hospital, Texarkana, Arkansas. Practice limited to Roentgenology and Clinical Laboratory Diagnosis. Roentgenologist, Michael Meagher Memorial Hospital, Texarkana, Arkansas. Roentgenologist, Texarkana Sanatorium, Texarkana, Texas. Practised medicine for nine years, four years of that time in Bowie County. Dr. Moulton's many friends will be grieved to hear of his death, and this Society loses a valued member.

## BOOK REVIEWS

THE MEDICAL FOLLIES.<sup>1</sup> By MORRIS FISHBEIN, M.D., Editor of the *Journal of the American Medical Association*. 233 pp. New York: Boni & Liveright.

Here is a book that might very well have carried this appropriate subtitle: "Arraigned at the Bar of Public Opinion."

It is obvious that those sections of the public which could be largely benefited by the truth are the actual and potential "suckers," the ignorant, the willfully blind, and those who have no desire to be bereft of their delusions. The remainder, who, happily, comprise the majority of the reading population, will experience amusement, regret and righteous anger, or a mixture of all three, proportionate to the reactions aroused in their consciousness by the efforts, past and present, to prey upon their credulity. The rise and fall of the various fads and fancies of medicine as evolved by advocates of preposterous and fallacious theories, some of which were conceived for the purpose of deliberate fraud and others in the uncurbed delusions of fanatics, and all against the "peace and dignity" and the health of the public, are explained with a clarity and convincing logic that leaves little room for argument.

It may as well be said at once that in this volume Dr. Fishbein has done a great service to the cause of scientific medicine. There are around 140,000 physicians and surgeons in America and of these more than 90,000 compose the American Medical Association, the largest and most powerful body of medical men in the world. Dr. Fishbein, as Editor of the *Journal of the American Medical Association*, is their official spokesman, and, in consequence, it

is apparent that what he has to say has the endorsement of the majority of the profession in this country. The old-fashioned doctor of yesterday was the esteemed and respected confidant of his particular public; to-day the individual physician may hesitate to comment freely on a "medical folly." The spokesman of the professional body is not restrained by a false delicacy which is equivocal at best—hence this book.

The author takes up the "follies" in chronological order. First on his list is Elisha Perkins and his metallic tractors.

A chapter is devoted to the history of homeopathy. The decline of that school of medicine, as shown in the figures recorded by the author, will come as a great surprise to the public. Dr. Fishbein dates its "ultimate collapse" to 1900. He attributes its fall to two influences, both brought to bear on medical education.

The first educational number of the *Journal of the American Medical Association* [says the author] was published on Sept. 21, 1901. It listed the medical colleges in the United States, the type of education and preliminary educational requirements enforced in each school and its provisions for didactic and clinical teaching. It showed there were 124 regular medical schools, 10 eclectic schools and 21 homeopathic schools, and it pointed out their qualities and their deficiencies. The poor schools began to wilt and fade—and many of the homeopathic schools were poor ones. By 1905 their graduates were fewer in number than in any year since 1880. In 1907 there were but seventeen homeopathic schools left, in 1908 but sixteen, in 1909 fourteen, in 1912 ten, in 1915 eight, in 1921 five and in 1925 there remain but two, and one of these carries a low classification. Altogether during 1923 there were just forty-nine homeopathic graduates.

Publicity is a powerful tool. Students who observed the gradual decline of homeopathy began to seek regular schools. In fact, many a young man who had been doctored in his early youth by a homeopathic physician was advised by that very physician not to enter a homeopathic college. The fact is, indeed, that homeopathy died from within.

Hahnemann read in a book on materia medica written by William Cullen, Professor of Medicine at Glasgow and Edinburgh, that Peruvian bark, the source of quinine,

<sup>1</sup> Reprinted in part by permission from the *New York Times Book Review*, Sept. 6, 1925, p. 11.

would cure malaria. This was and always has been true. Hahnemann, who did not know that malaria was caused by a living organism in the blood called the *plasmodium malariae*, because the organism had not then been discovered, "evolved the theory that perhaps quinine cured malaria because it would produce symptoms like those of malaria if given to a healthy man." He tried it on himself and it did. His hypothesis became the basis of the system called homeopathy, expressed in the phrase *similia similibus curantur*, "like cures like." "In simpler terms," says Dr. Fishbein, "the conception was that the drugs induced a condition which was substituted for the actual disease and the body could easily get rid of the substitute."

The author concedes, however, that Hahnemann's influence was certainly for good. . . . The great points in his favor are that he emphasized the individualization of the patient in the handling of disease, he stopped the progress of half a dozen or more peculiar systems of treatment based on a false pathology and he demonstrated the value of testing the actual virtues of drugs by trial. Any criticisms which might be brought against him, the author concedes, apply equally well against a large part of the other medicine of his time.

Two chapters are devoted to the histories and absurdities of osteopathy and its offshoot, chiropractic. Dr. Fishbein asserts that "osteopathy as it is practised to-day is essentially an attempt to get into the practice of medicine by the back door."

If osteopathy, as practised to-day, is an attempt to get into the practice of medicine by the back door, chiropractic, in the author's view, is an attempt to enter it by the cellar. He holds it to be a top-notch in money-making quackery—and, in addition, dangerous. Chiropractic is described as diagnosis and treatment in which the al-

leged theory is that disease is caused by certain bones of the spine impinging on certain nerves. Disease is cured by pushing those bones off those nerves until by some unknown mechanism of physiology they are persuaded to stay off.

Dr. Fishbein declares, however, that extensive experimentation has failed to disclose that such pressure on the nerves can be found to exist. The fundamental dogma of chiropractic, he holds, is simply a complete misrepresentation of the demonstrable facts. . . .

For originality in conception, the acme of quackery may be said to have been reached by the "Abrams box," the invention of the somewhat recently deceased Albert Abrams of California. The facts of this contraption have been too lately the subject of public notoriety to require more than brief mention here.

There is a chapter on fads in health legislation; another on birth control, an unsolved problem. There is also one on the anti-vivisectionist and animal experimentation. The great benefits that have come to humanity and to the lower animals through the conquest of many devastating infectious diseases through scientific experiments on animals, often painlessly and at most with little suffering, are pointed out. "The truth about rejuvenation" is told in a separate enlightening chapter.

"The Medical Mistakes of the Press" is somewhat amusing but more instructive, while "The Science of Healing" deals with epoch-making achievements in the medical field.

Any one can read this book with profit to himself. Physicians can render an excellent collateral service to their patients by keeping a copy of it on their waiting room tables. . . .

VAN BUREN THORNE.

A SYSTEM OF RADIOGRAPHY, WITH AN ATLAS OF THE NORMAL. By W. IRON-SIDE BRUCE. Second Edition, edited by J. MAGNUS REDDING, F.R.C.S. (Eng.), L.R.C.P., Senior Surgical Radiologist, Guy's Hospital; Consulting Radiologist, Edenbridge Hospital, Etc. 197 illustrations, 97 pages. H. K. Lewis & Co., Ltd., London. 1924.

The title of this publication is misleading inasmuch as it represents only a presentation of the various accepted radiographic positions as applied to the osseous system. No attempt has been made to include the technic utilized in the examination of the teeth, sinuses of the head, and gastro-intestinal tract. The consideration given the examination of the chest and urinary tract is surprisingly insufficient and these might better have been omitted altogether.

The standard positions utilized in the examination of the bones and joints are well illustrated. Many of the accepted positions, however, are not included. The scheme of providing illustrations of various normal parts, made in different positions and characteristic of different age periods, will be instructive to the inexperienced.

It is to be regretted that such a common necessity as the Potter-Bucky diaphragm is not mentioned, and the quality of many of the illustrations would no doubt have been improved if such a device had been utilized.

The first edition of this book, which appeared in 1906, no doubt fulfilled a definite purpose; it is difficult, however, to appreciate the need of a superficial work of this sort at the present time.

J. D. CAMP, M.D.

## ABSTRACTS OF CURRENT LITERATURE

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**The contralateral lung.**—A classification of the status of the contralateral lung is necessary if accurate deductions based upon end-results are to be made. The end-results of pneumothorax therapy are less dependent upon the status of the contralateral lung than they are upon the character of collapse and type of disease in the worse diseased lung.

The various types of contralateral lung lesions vary greatly in their prognostic significance. Fibrocaseous infiltrations involving the upper portion of the lung offer a more favorable prognosis than the bronchogenic extensions into the lower portions of the lung. The mere presence of disease in the contralateral lung does not contra-indicate collapse of the worse diseased side. Râles in contralateral lung disease must be carefully studied, in order to determine their pathological significance. The absence of râles in a diseased contralateral lung by no means indicates absence of activity.

Cavity cases with abundant expectoration should be subjected to early pneumothorax treatment in order to prevent aspiration infection of the opposite lung.

Very active contralateral lung disease should be allowed to subside before instituting pneumothorax on the worse diseased side. In the presence of contralateral lung disease great caution should prevail in collapse of the worse diseased lung.

Flexibility or rigidity of the mediastinum plays an important rôle in the behavior of the contralateral lung during collapse. Excellent results are occasionally attained by cautious collapse even in the presence of extensive contralateral disease.

Satisfactory end-results are frequently proportionate to the degree of watchfulness accorded the contralateral lung.

The status of the contralateral lung should be observed by frequent physical examination, and accurate records should always be maintained. Auscultatory phenomena transmitted from the worse diseased to the contralateral lung should be differentiated from those findings due to active disease in the contralateral lung. The contralateral lung, when diseased, should always be suspected when unfavorable clinical symptoms arise.

In this series, in the presence of satisfactory collapse of the worse diseased lung, end-results were much better with any type of contralateral lung disease than those of the "no free pleural space" cases, with an essentially negative contralateral lung.

Out of 345 collapsed cases, progression of the disease in the contralateral lung, demanding discontinuance of the pneumothorax treatment, took place in 24 cases.

Heretofore possibly too much conservatism has been exercised in the selection of material presenting contralateral lung disease.

L. R. SANTE, M.D.

*Observations Concerning the Contralateral Lung in Pulmonary Tuberculosis Treated by Artificial Pneumothorax.* Ray W. Matson, Ralph C. Matson and Marr Bisailon. *Am. Rev. Tuberc.*, Jan., 1925, p. 562.

**Filterable viruses.**—The author has studied Gye's cultures with the aid of a specially constructed dark-ground illuminator and a specially designed microscope for ultra-violet photography. As a result of a long series of comparative observations on cultures, all of which had ultimately been proved by animal experiments to be infective, the writer came to the conclusion that the same type of phenomenon, but on a smaller scale, is to be observed in the Rous fowl sarcoma, mouse sarcoma 37/s, and latterly in human carcinoma, as can be seen in cultures of bovine pleuro-pneumonia, except that the cultures from malignant growths are slower in developing and do not produce such rich cultures. He states that probably no single factor has hindered the cultivation of filterable viruses so much as the assumption that a culture in broth, for instance, must become opalescent, or that a growth on solid media must develop colonies easily visible to the naked eye. The writer believes that the spheroids which he has observed in the above cultures are probably an essential part of the life-history of these organisms, and consequently, owing to their low refractive index, they would have to be present in impossibly great numbers to produce evident cloudiness. The fluid cultures from malignant growths always remain clear; on solid media the colonies are so small that they require the use of a high-power objective to see them.

SOLOMON FINEMAN, M.D.

*The Microscopical Examination of Filterable Viruses.* J. E. Barnard. *Lancet*, July 18, 1925, p. 117.

**NOTE.**—Barnard and Gye believe that the small bodies seen and photographed are the actual virus of the disease. They base this conclusion partly upon the fact that control uninoculated tubes have been invariably blank, and partly upon the correspondence between the microscopical findings and the results of the experiments upon animals. Final proof is yet to be obtained, namely, the cultivation of the virus from a single colony, or, if possible, from a single spheroid, and the production of a tumor with the culture thus obtained. This work will be attempted as soon as circumstances will permit.

**Carcinoma of the cervix.**—This report includes all classes of primary carcinoma of the cervix—the early, borderline, or advanced—treated with radium alone. It is based on 188 cases treated between 1919 and 1923, grouped according to Schmitz' classification of primary carcinoma of the cervix uteri. Of these, 40 cases are in the two-year period, 12 had radium and operation, and three were secondary carcinoma, so the number to be reported on in tabulations is actually 133. In Classes I and II (operable), out of 31 traced, 23, or 74.1 per cent, were living at the end of three years; in Classes III and IV (inoperable), out of 102 traced, 35, or 34.3 per cent, were living at the end of three years, the total percentage of three-year cures in all cases being 43.6.

The dosage and technic are given and the author concludes as follows: (1) Every case of cancer of the cervix uteri should be studied individually. (2) The successful result does not depend entirely upon the direct killing of cancer cells, but also upon the cicatrization of the cervix and occlusion of the blood vessels. (3) The first dose of radium should be a therapeutic one. (4) The subsequent dose should depend upon the amount of healing and cicatrization seen six to eight weeks after the initial dose. (5) Repeated doses may be necessary to arrest the tumor cells persisting in the cicatrix. (6) Since results of radium treatment depend also on the defense reaction of the body and tissues, every effort should be made to secure for the patient a favorable environment following the treatment; and especially has it been found advantageous to use blood transfusions as an aid to this end.

*Preliminary Report of Primary Carcinoma of the Cervix Uteri Treated with Radium in the Woman's Hospital in the State of New York. Lillian K. P. Farrar. Am. Jour. Obst. and Gynec., Aug., 1925, p. 205.*

**The semilunar bone.**—Although first described by Peste in 1843, Kienböck's name is connected with this condition. The semilunar shows a definite atrophy and malformation possibly due to trauma and subsequently to the constant irritation of daily life. Kienböck believes that the condition is due to a momentary spontaneously reduced luxation, in the course of which there is an avulsion of the dorsal ligaments.

1. Kienböck's disease of the semilunar bone, or traumatic nutritional disturbance, with atrophy, with or without fracture, is a condition of rare occurrence, but is probably occasionally overlooked or diagnosed as sprain or "rheumatism."

2. The lesion may occur as the result of severe trauma, oft-repeated minimal traumata, or possibly from anatomical malformation.

3. The symptoms are wrist-joint disability, local pain and tenderness and sometimes retraction of the head of the third metacarpal bone.

4. The diagnosis is best made by the X-ray.

5. Treatment is conservative in the early stage; operative in older cases.

6. Prognosis for complete return of function is not good.

7. The literature is reviewed and three cases reported.

L. R. SANTE, M.D.

*Kienböck's Disease of the Semilunar Bone. Ralph Goldsmith. Ann. Surg., April, 1925, p. 857.*

**Malignant neoplasms.**—This paper presents merely a short description of a few cases of malignant neoplasms which are interesting in regard to the possible etiology, or unusual as to the sex of the carrier, and the size and location of the neoplasm.

1. Atheroma of the scalp, with rodent ulcer of the superfaccial skin, unusual as to size of the sebaceous cyst, 15 x 18 cm., and the development of a superficial carcinoma, probably from wearing a cloth over it.

2. Carcinoma implanted on longstanding lupus of the nose. Lupus vulgaris on nose for seventeen years. A hard tumor developed in the lupus-involved area on the tip of the nose. A second ulceration occurred at the inner canthus of the eye, both malignant, one rodent ulcer type, the other an acanthoma type; both disappeared under radium treatment.

3. Carcinoma implanted on longstanding lupus of nose, similar to last case. Steinhäuser has collected eighty-three cases of cancer following lupus.

4. Epithelioma of lip, with fatal liver metastases.

5. Carcinoma of ear, caused probably by irritation from straw on which patient slept.

6. Carcinoma of ear implanted in longstanding lupus. Carcinoma in this instance was of simple adenoid type.

7. Lymphosarcoma of neck, extending from mastoid region to clavicle, gave no symptoms of compression.

8. Osteosarcoma of sternum in child. Two tumors appeared on chest, rapidly growing in size, reaching fifteen centimeters in diameter each. Pathological and X-ray examination, osteosarcoma of sternum. X-ray treatment resulted in almost complete disappearance of right-

sided tumor; little, if any, effect on left-sided tumor.

9. Primary simultaneous carcinoma of both breasts.

10. Carcinoma of the male breast of Paget's type.

11. Roentgen-ray epithelioma of hand.

L. R. SANTE, M.D.

*Some Unusual Cases of Malignant Neoplasms.* Joseph K. Narat. *Ann. Surg.*, March, 1925, p. 679.

**Intestinal conditions.**—The rarity of intestinal occlusion, as reported in the foreign literature, where the ratio is said to be one case in 20,000 necropsies of the newborn, leads the authors to urge that more postmortem examinations be made of cases of infants who die of a "weakened condition." They define the term "atresia" as referring to the imperforation of an opening or of a canal, "aplasia" as defective development in a tissue, "stenosis," a narrowing or constriction, and "occlusion," the blocking of an opening. They review the embryology of the intestinal tract, the etiology of intestinal atresia and aplasia, and discuss the symptoms and diagnosis. The symptoms of the latter are: (1) vomiting; (2) obstipation—at least abnormal stools; (3) abdominal distention, as a rule, and with it, at times, umbilical distention; (4) anuria; (5) collapse—late. The onset of vomiting varies with the site of the obstruction, as a rule appearing earlier the higher the obstruction is located in the intestine. It usually appears the second day; in the case reported in this paper it was present from birth.

Very few radiologic reports have been published, and E. W. Peterson (*Acute Intestinal Obstruction in Infancy and Childhood: A Brief Review of 55 Cases.* *Surg., Gynec. and Obst.*, Oct., 1922, p. 436) makes a plea for a more general use of this procedure, which the authors think well of. The signs to be looked for are dilatation and filling proximal to the obstruction, with prolonged retention and ineffectual peristalsis. C. H. Shroder calls attention to the fact that, as in the case of the adult, the duodenum is best shown by having the child lie on his abdomen or by having him in a standing position. The following point has occurred to the writers of the present paper: Might it not be wise to advocate the routine administration of small amounts of barium sulphate at birth, and, if symptoms of obstruction present themselves, gain information from the roentgen ray within twenty-four hours? Up to the present time, such cases have remained too long unrecognized, and a barium study delayed may, of course, merely mean loss of valuable time.

The relative infrequency of intestinal aplasia may influence one in making a diagnosis between

this condition and intussusception, the authors state. They quote Peterson as finding 83 per cent due to the latter, in a study of 55 cases, twice as many males as females. The remaining small percentage was distributed among the various other types of obstruction, and the rarity previously mentioned should influence one in making a definite diagnosis.

One case is reported in detail.

Rectal atresia is likewise a rarity, of which the embryology and etiology are reviewed. One case is reported.

*Congenital Abnormalities of the Intestine: Intestinal Aplasia, Atresia of the Rectum and Anus Complicated by Rectovesical Fistula, with Report of Cases.* Robert E. Farr and Clarence W. Brunkow. *Archives of Surgery*, Sept., 1925, p. 417.

**The elbow joint.**—Although injuries to the elbow joint are very common, especially in children, separation of the epiphysis at the head of the radius is most infrequent. Because of the rarity of the lesion as well as its possible effect on the growth of the radius and the function of the elbow joint, this case is described.

The upper radial epiphysis of a child eleven years old was separated and displaced as the result of a fall of four feet in a gymnasium. The epiphysis was seen at X-ray examination to be displaced to the outer side and to lie perpendicular to its normal position. The patient was operated on and the epiphysis replaced.

Examination two years later revealed union of the epiphysis with the shaft in the injured elbow and a still persistent epiphyseal line in the normal forearm. One year later this had united and there was about one centimeter difference in the length of the two forearms. The condition is very rare, and reported instances are recorded.

L. R. SANTE, M.D.

*Separation of the Upper Epiphysis of the Radius.* Albert H. Montgomery. *Archives of Surgery*, May, 1925, p. 961.

**Gynecologic conditions.**—One hundred and fifty-six cases treated during the past four years are the basis of the report: sixty-six were of chronic metritis; twenty-one, fibroids; forty-one, carcinoma of the cervix; seventeen, carcinoma of fundus, and eleven miscellaneous cases. In chronic metritis, platinum tubes 1 mm. thick with 2 mm. of rubber were the filters used. In most of the cases 1,200 mg. hr. were given at one dose in two 50-mg. tubes in tandem. The results were very satisfactory and uterine bleeding stopped in five to six weeks, the uterus in nearly all cases becoming smaller. Ordinarily only small fibroids were treated (the group in-

cluded twenty-one cases); in three instances only were they larger than a fetal head. Pedunculated tumors were never treated.

Using same filtration the usual dose was 1,200 mg. hr. In one patient twice this dose was administered. In all but two, the bleeding stopped with a single 1,200 mg. hr. dose. Many of the fibroids disappeared entirely; some were reduced in size.

Carcinoma of the cervix was treated in forty-one cases: thirty-four of them were inoperable; seven were borderline; no clearly operable case was included. In each instance 2,400 mg. hr. of radium, filtered as indicated before, was given. Nearly all of the advanced cases, however, required a repeat of the same dose four to six months later, and it has been found advisable to accompany this treatment with X-rays over abdomen and back. Little hope is entertained for the ultimate complete recovery of the advanced cases; however, the writer is "of the firm opinion that radium treatment either alone or with X-ray is the best palliative remedy at our command."

Of the seventeen cases of adenocarcinoma of the fundus, seven were advanced, ten were fairly early, having the fundus movable. Twenty-four hundred mg. hr. of filtered radium was administered; three patients had a second similar dose, six months later; one patient had three such treatments. Of these seven advanced cases, four have died, two have disappeared, one is living one and one-half years. It is noteworthy that the one surviving patient of the severe cases received the largest dosage of radium, 7,200 mg. hr., together with X-ray anteriorly and posteriorly over the abdomen. She now has evidence of carcinoma. In the early cases hysterectomy was performed after radiation.

L. R. SANTE, M.D.

*Gynecological Conditions Treated with Radium Alone or Combined with Surgery. William S. Smith. Surg., Gynec. and Obst., May, 1925, p. 598.*

**Duodenal ulcer.** — The type of operative procedure necessary for the relief of duodenal ulcer cannot be determined by clinical symptoms or physical examination; even the X-ray is often of no avail in determining the type of operation which should or can be done. The conditions arising upon operative exposure of the lesion that make for the decision as to type of operation to be performed are in the main covered by: (1) the fixation of the duodenum at the site of the ulcer; (2) the amount of contraction or stenosis of the duodenum; (3) the amount of exudate present; (4) the presence of perforation; (5) the involvement by means of attachments to the gall bladder and pancreas.

If the duodenum is movable and patulous, simple excision and plastic operation can be performed; if immobile and stenosed, posterior gastrojejunostomy is the operation of choice. Operations tending to the complete removal of all acid-secreting mucous membrane are not favored by the author. Many gastro-enterostomies—the incidence varying from 2 to 10 per cent—are followed by marginal ulcers. The author feels that Horsley's operation deserves special consideration in eliminating these undesirable features. In this operation we have the removal of the ulcer and the almost complete retention of the physiology of gastric digestion, both as to proper period of maceration and attrition and the normal or almost normal chemistry. In this operation the ulcer is excised, the duodenum mobilized for plastic work, and the meal leaves the stomach by the pylorus. Cholecystectomy is usually performed at the same time, owing to the frequency of gall-bladder involvement and the fact that the operation is most readily done after cholecystectomy.

L. R. SANTE, M.D.

*The Operative Treatment of Duodenal Ulcer, with Special Reference to the Horsley Operation. John F. Erdmann and Rupert F. Carter. Annals of Surgery, March, 1925, p. 631.*

**Submaxillary region.** — Swellings of the submaxillary region result from a number of causes. Acute inflammatory swellings, virtually cellulitis, occur from dental abscess.

These are essentially due to osteoperiostitis and the site of the swelling depends on the point at which the infection breaks through. A very constant finding where there is osteoperiosteal involvement is the occurrence of trismus. This is more intense in involvement of the molar regions and it is practically never present with simple lymphatic involvement which occurs in tonsillitis. Lymph nodes may be involved, causing swelling in the region of the angle of the jaw from infection, tonsillitis, etc.

Where the lymph node involvement is in the submaxillary region it is usually from some more diffuse infection, for instance, Vincent's angina infection of the gums. In the absence of tonsillitis or acute infections in the mouth, what other conditions may cause an acute or subacute tender swelling in the submaxillary region? The submaxillary gland may be enlarged from an obstruction of Wharton's duct by a calculus. Chronic obstruction of the duct may be present from inflammation, no stone being present.

Carcinoma beginning in mucous membrane of the cheek, gums, or floor of the mouth causes lymphatic enlargement in the submaxillary region. Syphilis, tuberculosis, certain forms of

leukemia, dermoid cyst and ranula also give rise to swelling in this region.

In conclusion, the author wishes to emphasize the differentiation between the three most common acute inflammatory swellings appearing beneath the border of the mandible:

(a) Infection from the teeth and alveolar process causes a periostitis with extraperiosteal cellulitis and submaxillary phlegmon, not through lymphatic channels but by direct extension into the soft tissues from the periosteum. It is characterized by marked trismus, or limited opening of the mouth, particularly when the molar teeth are implicated.

(b) Infection from the gums, mucous membrane of the floor of the mouth, tongue or tonsillar region, causes submaxillary lymphadenitis, the swelling here being unaccompanied by trismus of any consequence.

(c) Obstruction of Wharton's duct by calculus or by inflammation without calculus may cause acute inflammatory enlargement of the submaxillary salivary gland. There is nearly always evidence of inflammation beneath the tongue, and swelling and pain are increased on eating. X-ray may show stone, or the latter may be palpated. Trismus is not a prominent feature.

L. R. SANTE, M.D.

*Swellings of the Submaxillary Region.* Robert H. Ivy. *Annals of Surgery*, March, 1925, p. 605.

**Brain tumors.**—The percentage of brain tumors and of other gross intracranial lesions which cannot be localized by clinical methods of examination alone is considerable. It has been found that in association with newgrowth there is a marked enlargement of the portion of the brain involved, naturally on account of the increased size of the tumor, but also due to increased fluids in edema. Observations on normal skulls have shown approximately 50 per cent of adults with calcification of the pineal gland. This in itself is of no pathological significance. Displacement of the pineal gland, however, from its normal midline position may be a great diagnostic aid to the surgeon. In the ordinary posterior anterior view of the skull the pineal gland is lost in the shadow of the nasal sinuses, so for this purpose a special technique is required. Patient lies on his back, plate under the occiput, ray directed from before backward parallel to a line from the external canthus of the eye to the external auditory meatus and centered accurately in midline. The deviation of the pineal gland is of significance.

When the pineal gland is calcified (in about 50 per cent of all skulls), its position gives diagnostic information in cases with intracranial

pressure. The shift has been found with brain tumors, brain abscess, and in certain cases of brain swelling consequent upon a vascular block.

A position of the pineal to the right of the mid-sagittal plane indicates a left-sided lesion above the tentorium.

A position of the pineal to the left of the mid-sagittal plane indicates a right-sided lesion above the tentorium.

A position of the pineal in the mid-sagittal plane in the presence of intracranial pressure indicates equal pressure on the two sides. In the chronic form of intracranial pressure as due to tumor or abscess, this means internal hydrocephalus. This has been found occurring in lesions of the posterior fossa and distortion of the third and fourth ventricles.

L. R. SANTE, M.D.

*A Method for the Localization of Brain Tumors—the Pineal Shift.* Howard C. Naffziger. *Surg., Gynec. and Obst.*, April, 1925, p. 481.

**Elbow fractures.**—The essayist classifies in groups and reports in detail on 181 fractures about the elbow joint, giving mode of sustaining fracture, method of reduction and after-treatment. Ninety-six per cent of the cases were followed up and the end-results shown. The largest group were of the supracondylar variety. In these (as well as all other fractures about the elbow with the exception of fractures of the olecranon process), the best position for treatment is acute flexion. Of even more importance than the position of reduction is the after-treatment. Early passive and active motion should be instituted, beginning at one week. Anatomically poor reductions with proper treatment may give good clinical results.

One very important observation was the disappearance of what was possibly myositis ossificans after a period of three years. Illustrations are given.

Children have excellent reparative powers in fractures.

Perfect anatomical approximation of the fragments is not always essential for functional recovery. Displacement and overriding of fragments will often result in a good functional limb and complete restoration of the bony contour. Anatomically restored elbows may be lacking in mobility unless they are treated judiciously. The best results are obtained by immediate reduction under an anesthetic, with the aid of the fluoroscope. Partial immobilization with adhesive and early active motion will reduce swelling, increase muscular tonicity, and prevent muscular spasm, exuberant callus, Volkmann's ischemic paralysis, and myositis ossifi-

cans. Passive motion with or without an anesthetic and active massage retard progress. Musculospiral and ulnar paralysis accompanying and following fractures about the elbow are not always permanent. Myositis ossificans will disappear with the discontinuation of trauma to the brachialis anticus.

Open operations in children are not indicated, as good functional limbs will follow displacement of fragments, and infections are very prone to follow open operations.

Compound fractures are best treated by débridement, Carrel-Dakin sterilization, suspension in flexion by adhesive or in a flexed Thomas splint, to be followed by secondary suture or granulation, with the institution of early active motion.

L. R. SANTE, M.D.

*Elbow Fractures and Dislocations. Treatment and Analysis of 181 Cases at Bellevue Hospital, New York City.* Irwin E. Siris. *Surg., Gynec. and Obst.*, May, 1925, p. 665.

**Cholecystography.**—In the case of experimental animals the writers found that practically twice as much of the bromine as the iodine salt is required to produce a shadow of the same density, and that the toxicity of the two compounds is approximately the same. For this reason they employ the iodine salt and have used it in forty patients.

In the normal human subject, 0.045 gram per kilogram of body weight of tetraiodophenolphthalein will cast a distinct shadow of the gall bladder. As low as 0.040 gram per kilogram of body weight has proven sufficient in some cases.

The quantity of salt to be injected is weighed out, placed in a clear 100 c.c. flask, and freshly distilled water is added to make a 10 per cent solution. To this is added 1.5 to 2.0 c.c. of a 10 per cent solution of sodium carbonate, which is necessary in order to keep the salt in solution. The solution is filtered, autoclaved at 15 pounds' pressure for 30 minutes, and kept well sealed in a dark place. No solution has been used later than 24 hours after preparation. Injection is given intravenously by gravity method and the total amount of fluid administered is 125 to 150 c.c. Administration in 1 to 2 per cent solution in normal saline has given only one mild reaction in twenty cases.

After the injection is made in the morning, no food should be taken for nine hours; water is allowed, however. The patient should remain in bed, lying preferably on the right side. Films are taken at 6, 9, 12, 24, and 36 hour intervals. One-half hour before the first (6-hour film) an S.S. enema with 5 c.c. of turpentine is ad-

ministered to relieve gaseous distention, and a rectal tube is inserted for five minutes prior to each subsequent examination.

After the 9-hour film cocoa and toast are given to see if food will cause a shrinking in the size of the biliary shadow. The patient may have regular diet the next day. There does not seem to be any absolute contra-indication to administration of the drug. Roentgenographically, ordinary gall-bladder technic is used in conjunction with a Potter-Bucky diaphragm. The findings previously outlined by other writers were in general confirmed. The writers "believe that such a remarkable advantage of cholecystography over clinical methods of diagnosis, together with its very slight inconvenience to the great majority of patients and apparent lack of danger, justify its routine use in cases in which there is any question of the diagnosis."

L. R. SANTE, M.D.

*The Clinical Use of Sodium Tetraiodophenolphthalein in Cholecystography.* Gibbs Milliken and Lester R. Whitaker. *Surg., Gynec. and Obst.*, May, 1925, p. 646.

**Benign tumor.**—The exceeding rarity with which central benign giant-cell tumor of the proximal phalanx occurs, is the reason for reporting this case.

Patient was a white woman, 36 years old, who at first examination presented a swelling over the inner side of the left thumb, about 2 cm. in diameter, which she attributed to a bruise sustained three years before. Nothing other than this is of special significance in the history.

X-ray examination revealed in the center of the proximal phalanx of the thumb a well-marked area of decreased density with well-defined edges, as well as a second area of rarefaction nearer the distal end of the phalanx on its dorsal and medial aspect. No new bone formation could be seen in the bone nor in the tumor mass in the soft parts. The cortex was perforated and there was no expansion of the shaft of the bone. Operation and section established the diagnosis.

L. R. SANTE, M.D.

*Xanthosarcoma of Thumb.* Vincent Vermooten. *Ann. Surg.*, April, 1925, p. 851.

**Tuberculosis.**—So many new remedies for tuberculosis have sprung up only to be discarded as useless after more mature deliberation that it is well not to accept too soon the statements of some as to the effect of ultraviolet radiation in pulmonary tuberculosis.

At the J. N. Adam Memorial Hospital of Ferrysburg, New York, good results have been obtained in the treatment of bone and other

"surgical" tuberculosis for a sufficient period of time to justify its use in this type of the disease. Rollier is quoted as convinced that heliotherapy would be a useful factor in the treatment, since any "treatment causing improvement in the general health of the patient is our best means of combating pulmonary as well as surgical manifestations."

To this end, in order to determine the true worth of ultraviolet therapy in pulmonary tuberculosis, a selection of cases with "control" cases not receiving ultraviolet, but only the sanatorium rest, is being attempted. Roentgenograms illustrating subsidence, and even to some extent resolution, of the lesion are shown in cases where sanatorium treatment alone was used.

Ultraviolet radiation up to fifteen minutes' exposure increased cough and tightness in the chest. Auscultation showed more râles, probably from local congestion. Sputum usually decreased in amount. Tubercle bacilli disappeared from some, but remained a constant finding in others undergoing treatment. Hemoptysis, on the whole, seemed to be less during this treatment. Very few had reduction in temperature. There seemed to be no definite improvement in weight of the patients.

L. R. SANTE, M.D.

*Heliotherapy in Advanced Pulmonary Tuberculosis.* I. D. Bronfin. *Am. Rev. Tuberc.*, April, 1925, p. 96.

**Hyperplastic tuberculosis.**—The subject of the paper is a discussion of the pathological findings in tuberculous involvement of the cecum, its clinical forms, and their differential diagnosis. X-ray is a great aid in differential diagnosis of this condition.

1. There occasionally occurs in tuberculous patients a tuberculous process localized chiefly in the cecum or colon and characterized by a predominance of scar tissue and round-cell infiltration to a degree closely simulating new-growth.

2. This process has been called hyperplastic tuberculosis, but recently authors have agreed on the term "tuberculoma," as more descriptive.

3. It is apparently noted more commonly in the pathological than in the surgical departments.

4. By causing chronic incomplete ileus this condition may produce a major handicap in the recovery from pulmonary tuberculosis.

5. The chief errors, both in pre-operative and operative diagnosis, are calling it appendicitis in young adults or cancer in middle or later life.

6. Incomplete or complete ileus may furnish the first definite symptoms.

7. In several classical cases and some reported more recently, histological differentiation was difficult or impossible.

8. Treatment: (a) In young adults simple exploratory operation or an exclusion anastomosis has been followed by excellent results. (b) Resection is preferable in good surgical risks. (c) In an old patient, where differentiation from cancer can be made, an exclusion anastomosis is preferable.

L. R. SANTE, M.D.

*Tuberculoma of the Cecum: Hyperplastic Tuberculosis.* Frederick C. Herrick. *Annals of Surgery*, April, 1925, p. 801.

**Pneumoperitoneum.**—Pneumoperitoneum is a most helpful method in diagnosis of pelvic lesions and in early pregnancy. There are three important points in the X-ray examination of the uterus, tubes and ovaries by the pneumoperitoneum method, which are necessary in coming to an opinion worth while:

1. All plates are made stereoscopically.

2. The examination is made by use of the Bucky diaphragm.

3. The position of the patient and direction of the rays must be such that no portion of the sacrum overshadows any of the pelvic viscera. Stereoscopic plates are used because with them the examiner can determine the relation of a mass shadow to the normal pelvic organs. The Bucky diaphragm is used because it is the only method at our command that gives marked contrast.

The position of the patient is face down on the Bucky with head lowered until the table reaches an angle of about 30 degrees. The rays are directed straight down at a point just below the tip of the coccyx. This causes the entire shadow of the sacrum to be thrown well above the outline of the brim of the pelvis.

The writer's technic with the Bucky diaphragm is as follows:

A 4½ to 6 inch back-up is used, depending on the size of the patient, with 40 milliamperes, 5 seconds, always at a distance of 25 inches.

Carbon dioxide is now used instead of oxygen for making the inflation of the peritoneum. It is rapidly absorbed and for this reason the procedure must be carried out in the X-ray room.

McClure and the author have been able to make out in the pregnancy cases a much thickened uterine wall with a distinct cavity and in this cavity a mass which they believe to be a pathognomonic sign.

The author feels that the following conclusions are warranted and conservative:

1. Inflation of the peritoneum by either the abdominal or uterine routes is perfectly safe

in cases in which there are no contra-indications.

2. There is very little pain if the patient is kept in the knee-chest or Trendelenburg posture during inflation and for fifteen minutes after it.

3. The method is of the greatest aid in obscure pelvic cases and will make an accurate diagnosis possible.

4. It is possible to diagnose with certainty pregnancy in the early weeks, provided the pathognomonic sign mentioned in the paper is shown in the roentgenogram.

L. R. SANTE, M.D.

*Pneumoperitoneum as an Aid in the Diagnosis of Obscure Pelvic Lesions and Early Pregnancy.* Lucius E. Burch. *Surg., Gynec. and Obst.*, May, 1925, p. 703.

**Colles' fracture.**—The trauma which produces separation of the lower radial epiphysis is the same as that which produces Colles' fracture in an older individual. The periosteum is rather loosely attached to the shaft of the long bones, but its attachment to the epiphysis is more firm, so that where the lower radial epiphysis is displaced backward, the stuffed-up periosteum remains fixed to it at its dorsal attachment, and later produces a band of bone; bone production on the volar surface is less abundant. Where the displacement has existed two weeks or more, open operation is required to replace it. Usually a small piece of bone of the diaphysis is pulled loose with the epiphysis. Union of the epiphysis usually occurs by bone formation and arrest in longitudinal growth of the bone may result if the epiphysis is not replaced exactly in position.

Colles' fracture after reduction does not tend to displacement, no matter in what position the

part is dressed. With epiphyseal separation there are no rough spicules of bone to hold it in place, and unless proper precautions are taken displacement may again occur. The most effectual way to hold the lower radial epiphysis in place is by extreme palmar flexion of the hand at the wrist.

L. R. SANTE, M.D.

*Treatment of Epiphyseal Separation of the Lower End of the Radius.* Isadore Zadok. *Archives of Surgery*, May, 1925, p. 969.

**Iodine for exophthalmic goiter.**—In March, 1922, Plummer first began to use iodine extensively in the treatment of exophthalmic goiter, his results not only revolutionizing the treatment of the disease, but sweeping aside overnight certain theories and principles of therapy that had become generally accepted through many decades of teaching. In treatment of exophthalmic goiter, ten drops of Lugol's solution (aqueous solution of 5 per cent iodine and 10 per cent potassium iodide) are administered daily. It may be used to tide over a stormy period in the disease, or post-operatively, where a pronounced reaction follows operation. Larger doses are now given in preparation for operation, with very good results,—ten drops of Lugol's three times a day or even up to every hour.

The nature of its action is not entirely clear, but according to Plummer it puts the gland at rest and allows it to complete its normal secretion.

L. R. SANTE, M.D.

*The Effect of the Administration of Iodine upon Exophthalmic Goiter.* Arnold S. Jackson. *Annals of Surgery*, April, 1925, p. 739.

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